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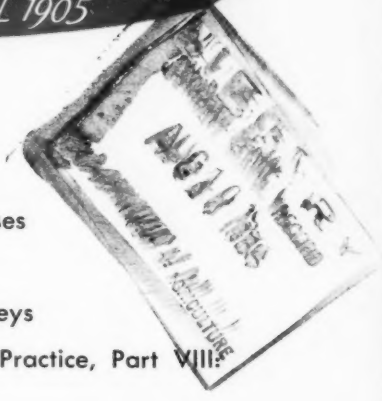
VETERINARY Medicine

Established 1905



features in this issue...

Helminth Infections in Horses

Mucosal Disease of Deer

Keratoconjunctivitis in Turkeys

Advances Made in Swine Practice, Part VIII: Listeriosis

Surface Tension and Relative Viscosity of Paunch Fluids

Development of a Basal Ration for Hospitalized Dogs

Dog Restriction and Management in Rabies Control

How to Prevent Malpractice Suits

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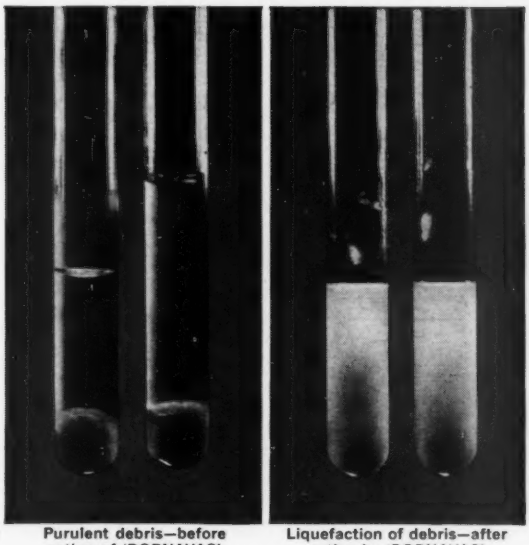

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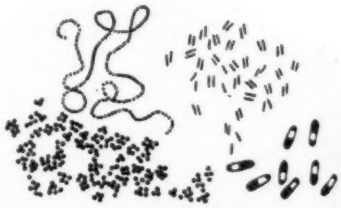

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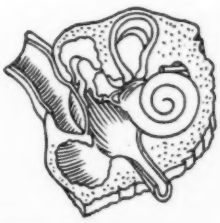

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Why Military Veterinary Medicine?

On May 15, 1956 Secretary of Defense Charles E. Wilson issued a memorandum to the secretaries of the Army, Navy, and Air Force, which requested that there be jointly prepared by the secretaries of the three services an "action program" for implementing the abolishment of the Veterinary Corps of the Army and Air Force. The "memorandum" appears as to be an effort to circumvent basic military organization legislation. The Veterinary Corps of the Army Medical Service was established by the National Security Act of 1916 and its existence was reaffirmed in the Army Organization Act of 1950.

Editorial comments in regards to this move by the Secretary have appeared in a number of veterinary journals (See VETERINARY MEDICINE, 51:339 [July], 1956). The American Veterinary Medical Association has given wide circulation to an "insertion" referred to in the Congressional hearing by Maj. Gen. W. A. Lawton, chief, Budget Division, Office Comptroller of the Army. This sets out analytically the importance of the mission of Veterinary Corps.

Readers are referred to and are urged to read, Changing Concepts of Military Veterinary Medicine, by Brig. Gen. Wayne O. Kester, that appeared as a feature presentation in the Anniversary Issue of VETERINARY MEDICINE (November 1955, page 631-634). In this article, General Kester explains why the profession is interested in the military, the role of the veterinary officer, and the significance of military veterinary medicine. "That a military community to survive must have a comprehensive preventive medicine program is unquestioned," wrote General Kester, "and that any total health program must include veterinary medicine is now an established and accepted fact in the military—a point of view becoming generally accepted in civilian communities."

The American public should be informed that the major role of military veterinarians is the cooperative efforts with medical and other science in preventing transmission of diseases of animals to man. That the Wilson memorandum should have ever happened perhaps points to the failure of the profession to marshal forces of veterinary opinion as a public relations effort. There is much testimony that might be advanced to corroborate the contributions of veterinary medicine to modern-day science from which the public continues to benefit. The issue is that the profession has advanced since the horse and buggy days, in spite of inference to the contrary, and in some significant instances has set the pace in advancement against the plagues of mankind.

VETERINARY Medicine

Established 1905

Registered in U. S. Patent Office

A Monthly Magazine Devoted to the Promotion of the Art and Science of Veterinary Medicine

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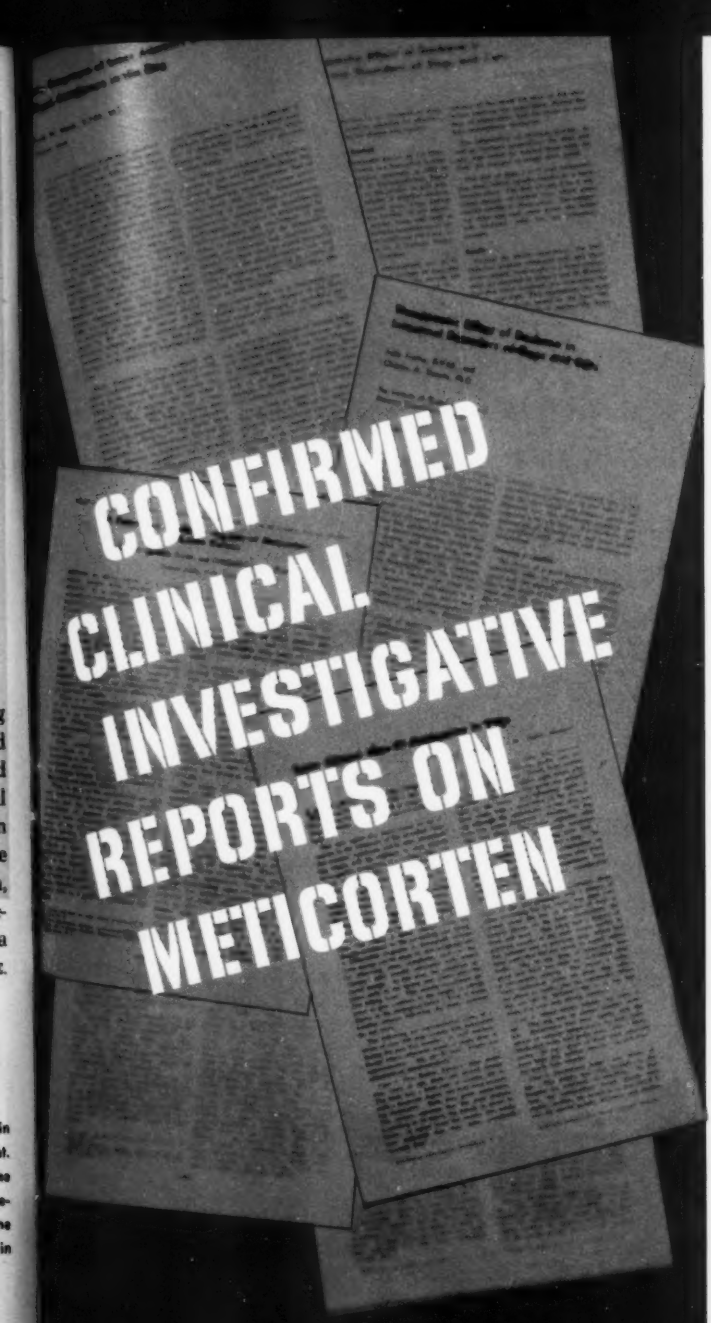

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1. Koger, R. B.: *Vet. Med.* 50:713 (Dec.) 1955.
2. Chambers, E. E.: *North Am. Veterinarian* 37:105 (Feb.) 1956.
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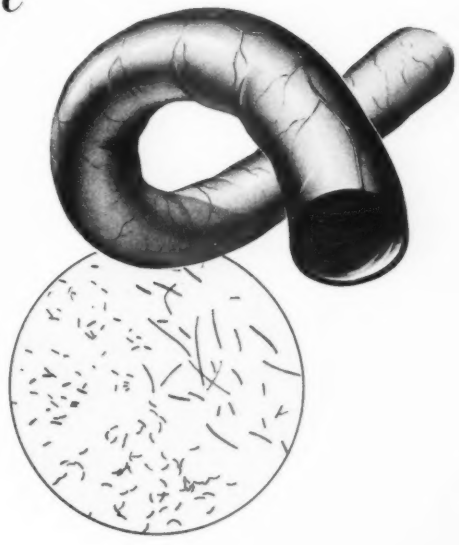

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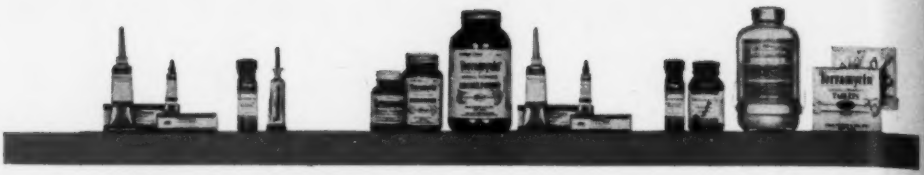

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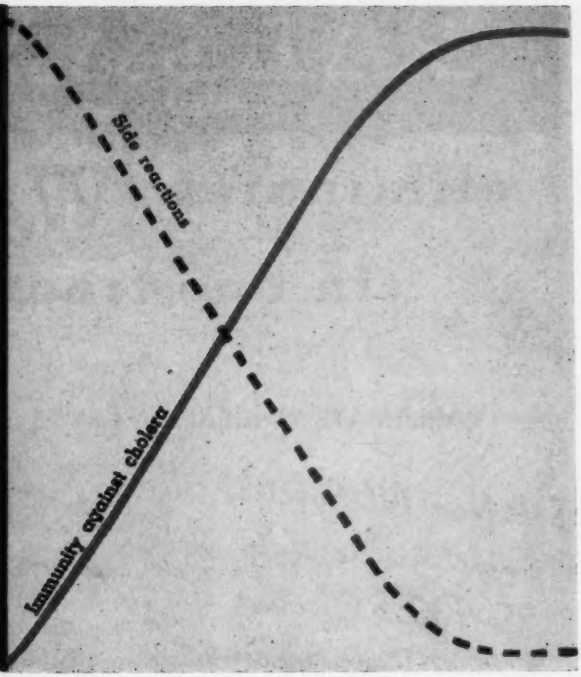

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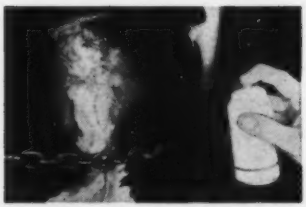

PROLAPSE OF THE VAGINA—Surgical closure of upper portion of vulva with wire sutures is dressed with Aeroderm, minimizing fecal contamination during healing.[1]

TAIL SURGERY—Docked tail of 4-month-old pup is dressed with Aeroderm to avoid injury by licking and to keep wound clean. (Photo courtesy Dr. R. E. Miller, Richmond, Indiana.)

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1. Conner, G.H.: Vet. Med. 50:259 (June) 1955.
2. Watts, R.E.: J.A.V.M.A. 125:40 (July) 1954.
3. Wendt, W. E.: Personal communication (Sept.) 1954.
4. Choy, D.S.J., and Wendt, W.E.: U.S. Armed Forces M.J. 3:1241 (Sept.) 1952.

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*Herrick, J. R. (1956) Bio-Chem. Rev., 26:1, 8.

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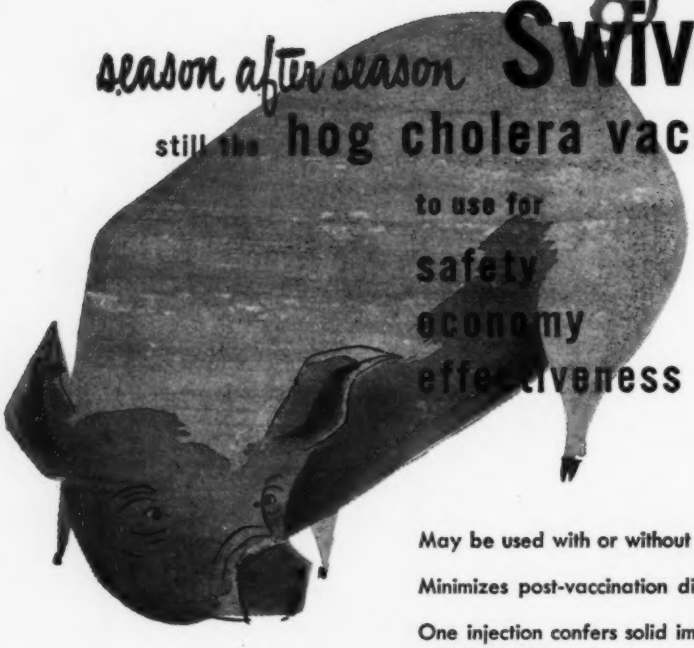

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Helminth Infections In Horses†

J. H. DRUDGE,* Lexington, Kentucky

HORSES are infected by more species of helminths than any other of our domestic animals. Dikmans[3] lists 53 worm species as parasitizing horses in this country, whereas several species in addition occur in other parts of the world. Representatives of 11 families are found, including forms commonly referred to as strongyles, ascarids, pinworms, stomach worms, tapeworms, threadworms, and lungworms. Not only are horses liable to infection by many different kinds of worms, but also large numbers of the various species may be present, particularly strongyles. Of the limited quantitative data on this fundamental aspect, Foster[3] suggests that infections of 30,000 to 50,000 strongyles are not infrequent. In the central Kentucky region ascarid infections in foals consisting of 500 to 1,000 worms are seen from time to time.

The damage or injury caused by several of these species may be the immediate cause of death. In general, however, the greatest overall injury is from the far less spectacular, insiduous effects which result in varying degrees of impaired growth, development, and performance. Nearly every organ or tissue of the horse is liable to invasion. During the immature stages of many of these worms, extensive migration takes place before the worms locate as adults in their preferred sites. Strongyles and ascarids are generally considered the most injurious species, although other worm parasites should be regarded as capable of producing severe injury, and contributing to the overall picture of parasitism wherever it occurs. In keeping with this relative significance, special emphasis will be placed on the strongyles and ascarids in this discussion. The treatment and control aspects will be stressed, because the general interest is understood to lie in these areas.

Strongyles

The designation, strongyles, refers to a large number of closely related species. For convenience, they have been divided into two groups, the large strongyles (sclerostomes), and the small strongyles (cylicostomes).

Only three species make up the large strongyle group, but these forms are injurious parasites. In addition to the blood-sucking activity of the adult worms, considerable damage is inflicted on the mucosa of the cecum and colon to which they are attached. One of the large strongyles (*Strongylus vulgaris*) is particularly notorious as the causative agent of verminous aneurysms, which develop as a result of the activities of the immature stages in the arterial walls, particularly the anterior mesenteric artery.

Although about 40 species are included in the small strongyle group, these forms are generally regarded as being less pathogenic than the large strongyles. This impression is gained from their usual lack of blood-sucking activity and loose association of the adult worms with the large intestinal mucosa. In addition, the larval migrations are limited for the most part

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†This paper was presented at the University of Pennsylvania Symposium on Helminthic Problems in Veterinary Medicine, May 10, 1955.

*Department of Animal Pathology Kentucky Agricultural Experiment Station.

*The investigation reported in this paper is in connection with a project of the Kentucky Agricultural Experiment Station and is published by permission of the Director.

to the wall of the intestine. Nonetheless, the encystment of the larvae and associated tissue damage, including nodule formation, in heavy infections is extensive and undoubtedly seriously impairs mucosal function.

Ordinarily, the two groups of strongyles are not differentiated by fecal examination for eggs. Taylor[39] has reported that counts of 1,500 to 2,500 eggs per gram of feces are indicative of clinical cases of strongyle infection. However, the presence or relative number of strongyle eggs in the feces does not necessarily indicate the presence or the extent of a verminous aneurysm in an animal. The number of strongyle eggs in the feces may be regarded as a general index of the animal's exposure to *S. vulgaris*, because it is known to occur widely along with the other strongyles. Fecal culture examinations may be used to diagnose the presence of adults of this species by its characteristic third (infective) larval stage.

Strongyles commonly infect horses of all ages, but the younger age groups are particularly liable to serious injury by these worms. Older horses are somewhat more resistant to strongyles, and lighter infections are more common in older animals. Nonetheless, the worms carried by the older animals serve as the important source of infection for the highly susceptible foals.

The objective of strongyle control, as for parasitic worms in general, is to interrupt the cycle of transmission. In addition to sanitary and management practices, medicinal procedures are used to achieve this goal by preventing or minimizing the contamination of the horse's food and water with the infective stages of the strongyles.

Control

A number of sanitary and management practices have been advocated for strongyle control: such as (1) clean, dry stalls, (2) feed and water protected from fecal contamination, (3) frequent pick-up of manure from paddocks and pastures, (4) manure composting, (5) chain harrowing and clipping pastures, and (6) rotation of animal species and pastures. Unfortunately, with the advent of more effective medicinal agents and procedures, there is a tendency to neglect the hygienic aspects. Although the sanitary and management practices are theoretically sound, it must be admitted that most horse breeders for various reasons are unable to do a complete job. Even then medication should supplement rather than replace wholesome food and water and clean surroundings.

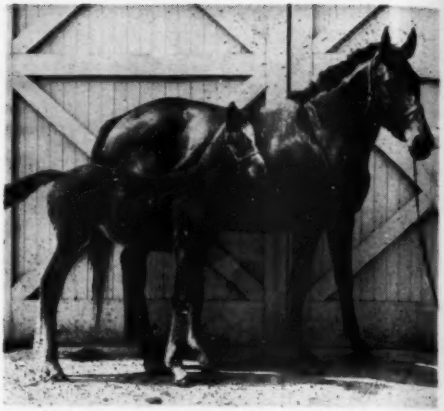

Photo Courtesy Kentucky Agricultural Experiment Station

A six-year-old mare that received 2 gm. of phenothiazine on her grain feeding daily for three years. This mare was successfully bred and foaled normally in the spring of 1950 and 1951.

Phenothiazine has been widely accepted as the most satisfactory treatment for both large and small strongyles inhabiting the cecum and large colon. Basically, two methods or systems of administering phenothiazine to horses are used: (1) Single, therapeutic doses, and (2) the low-level system in which small amounts are given daily.

Therapeutic doses of phenothiazine are given at the rate of 25-30 gm. per 1,000 lb. of body weight. The drug may be administered as a drench, by stomach tube, as a bolus, or on the feed. No preliminary fasting is necessary. Therapeutic doses are contraindicated for animals in poor condition or constipated. For weak, emaciated, or anemic horses, Howell and Britton[16] and Schwartz *et al.*[35] have suggested giving 5 gm. of phenothiazine daily until the full therapeutic doses is administered. The addition of bran to the ration is a helpful safeguard against constipation, according to Howell and Britton[16] who observed no constipating effects when the ration consisted of 25% bran.

In addition to the early observations of Haberman *et al.*[15], Taylor and Sanderson[30], and Howell and Britton[17], numerous reports attest to the efficiency of therapeutic doses of phenothiazine in removing adult strongyles which are in the lumen of the digestive tract at the time treatment is given. In effect, worms are removed after a considerable part of the damage has occurred, but removal of the worms temporarily interrupts the contamination of pastures with eggs. From the control standpoint, periodic therapeutic doses (*i.e.*, at six-month intervals) leaves considerable time between treatments for strongyle infec-

tions to build up and remain at high levels, unless pasture rotation is practiced in conjunction with treatment.

Repeating one-half therapeutic doses (12.5 gm.) at three-to four-week intervals is a system used for strongyle control on some horse farms in the central Kentucky area. This procedure has been evaluated by Todd[22] as providing the most successful strongyle control of any of the systems based on periodic treatments. The reduced possibility of toxic reactions appears to be another justification for employing the 12.5 gm. dose level. This dose level has not been critically evaluated, but it is probably below optimum efficiency in removing the strongyles, particularly the large strongyles.

Although animals in poor condition are more apt to react unfavorably to treatment, occasionally an apparently normal animal may suffer a serious reaction, manifested mainly by a hemolytic type of anemia, following therapeutic doses of phenothiazine. This unpredictable sensitivity of the horse to therapeutic doses of this anthelmintic, an undesirable feature attending its use, stimulated investigations on the divided dose procedure mentioned above and eventually led to the low-level type of administration as a control system. An additional limitation of therapeutic doses is their failure to affect aneurysms in the curative sense, or to be as effective prophylactically as the low-level system.

The impetus for the prophylactic use of phenothiazine in the horse appears to have stemmed in part also from the activity observed by Shorb and Haberman[26] of small daily doses on sheep nematodes. Numerous early studies[9,11,18,23,28,29,40] on small repeated doses in the horse agreed on the efficiency of this method of treatment in sharply decreasing strongyle eggs in the feces. This approach was pursued and developed by Dimock[8] into the low-level system of therapy as it is known and practiced on many central Kentucky horse farms today. The system consists of the daily feeding on the grain ration of 2 gm. of phenothiazine for the first 21 days of each month, which is followed by a rest period for the remainder of each month during which no drug is given. The intermittent periods of dosing and rest are repeated each month on a year around basis.

Recommendations for the application of the low-level system of administration for horse strongyle control have been detailed by Todd[22] following additional laboratory and field investigations. These recommendations are summarized as follows:

The schedule of treatment in foaling mares should be started when the mares are brought up in preparation for breeding and foaling, and continued as long as the mare has a foal by her side. Treatment is continued after the foals are weaned providing the mares are brought up and fed individually. It is also advisable to have barren mares on low-level treatment throughout the year. In general, suckling foals associated with treated mares will not need treatment. Sucklings may, however, be treated by tying the mare and allowing the foal to feed first from the mare's feed box containing 2 gm. dose of phenothiazine, or by providing the foal with a separate feed box and feeding 1 gm. of phenothiazine daily for the first 21 days of each month. Weanlings and

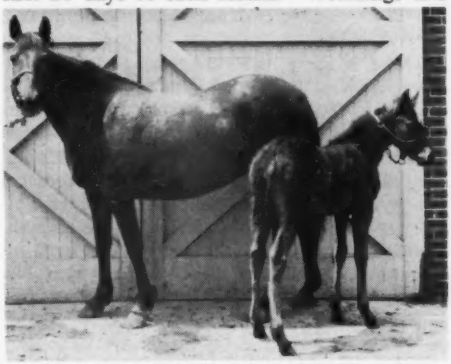

Photo Courtesy Kentucky Agricultural Experiment Station.

This ten-year-old grade mare received 4 gm. of phenothiazine daily for two years. Also pictured is her 1950 foal. No harmful effects of the continuous therapy have at any time been observed on either mare or foal.

yearlings should be placed on the regular 2 gm. daily dose schedule. This may be continued in yearlings taken up for breaking and light training and in horses in light training. Horses in heavy training and racing should not receive the low-level phenothiazine treatment. Stallions should be on the regular low-level schedule throughout the year.

The low-level system functions in a prophylactic or preventive way by markedly reducing contamination of pastures with infective strongyle larvae. Thus the liability of exposure of the animals is lowered considerably. This is brought about by the rather peculiar and complex action of small amounts of phenothiazine on the strongyles. The action may be described as operating in four ways: (1) The first and probably the most significant of these is the practically complete inhibition of egg production of the adult female strongyles. The observations of Gibson[11] indicate that this

sterilizing effect is temporary, lasting for about five weeks. More recent investigations by Drudge, *et al.*[6] suggest differences among the species of strongyles with respect to the ability to carry on the reproductive function in the presence of small amounts of phenothiazine. (2) There is an inhibition of the development of infective larvae in the feces from the eggs that are produced as reported by Gibson[11]. (3) Small daily doses of phenothiazine have been credited by Dimock[3] and Todd, *et al.*[22] with effecting the removal of the adult strongyles from the digestive tract. This point needs clarification in view of the incongruous findings of Gibson[11] and Drudge, *et al.*[6]. (4) Finally, the development of infective larvae, after they have been ingested, may be prevented, but this activity has not been adequately demonstrated.

There is no direct evidence, as far as the writer is aware, of any toxic manifestation from the low-level system of treatment in the horse. Horses have been observed[5,22] to tolerate small daily doses of phenothiazine for periods as long as four years, during which time the drug was given daily rather than for the regular 21-day per month schedule. Some of the animals in this study received as much as 4 gm. of phenothiazine daily for the first two years. No untoward, toxic effects were observed in any of the 12 animals employed in the study. The mares were bred successfully each year and foaled normally, and monthly blood examinations over the four-year period gave no evidence of developing anemia.

Recent investigations[23] point out a relationship between certain preparations of phenothiazine and thyroid activity in the burro. The antithyroid effect was confined to the impurities, including iodine, which remained in the phenothiazine preparations from the manufacturing process. Although hypothyroidism was suggested as one explanation for the observed relationship, this was not demonstrated.

The low-level system is regarded[22] as the best available means for horse strongyle control. From the parasite control standpoint, there have been no failures, as measured in death loss or severe damage directly ascribable to strongyles, to the writer's knowledge, where the system has been applied as outlined. At various times reports are received to the effect that the low-level system is not effective as indicated by fecal egg examination. The essential cause for these apparent failures has been due to failure to administer the drug.

The continuous administration of phenothiazine as practiced under the low-level system raises the question of whether drug-resistant strains of strongyles will develop, particularly in view of the apparently favorable conditions in which the worms are more or less in continuous contact with relatively small concentrations of the drug. Although such an unfortunate development is regarded as a possibility, there is no evidence to date that it has occurred.

Irrespective of the foregoing favorable indications, the low-level system has not been generally accepted and adopted for strongyle control in the central Kentucky region. As far as it can be ascertained this is not due to questionable efficacy. The objection has been described by some as one of marginal toxicity in which animals raised under this system do not grow out and perform up to expectations. Whether this contention has substance in fact, and can be ascribed to direct toxic manifestation of the drug, is not known.

Ascarids

Ascarid or large roundworm infection is primarily a problem in young horses. Sucklings and weanlings are particularly susceptible, while yearlings are generally less susceptible. Ascarid infection in older animals is uncommon, *i.e.*, only an occasional animal is infected and these infections are characteristically light. This decrease in susceptibility to ascarids as age increases is credited to acquired immunity resulting from the infections at an earlier age.

The injury produced by ascarid infections covers a wide range, from light infections producing moderate untoward effects to heavy infections which may be the essential cause of death. Several foals are necropsied each year in the department's diagnostic laboratory which show a ruptured intestine and peritonitis associated with a heavy ascarid infection. Serious

Fig. 1. This heavy *Parascaris equorum* infection was observed in a Thoroughbred weanling. Only a part of the 574 acarids harbored by this animal are shown here.

Fig. 2. Section of small intestine from a Thoroughbred weanling showing several *Parascaris equorum* protruding through a perforation located along the mesenteric attachment. These were associated with the fatal peritonitis.

lung damage, caused by migrating ascarid larvae, may result in pneumonia. More commonly, but probably more important, are the less spectacular effects which may be lumped under the description of retarded or impaired growth and development. This general unthrifty condition is associated with pot bellies, rough hair coats, and digestive disturbances.

Good sanitation and management practices can play an important role in the prevention and control of ascarids. Actually, sanitation in the control of ascarids, as with the strongyles, is essentially the proper disposal of manure. The same general sanitation procedures outlined for strongyle control also apply for ascarids. In comparison, ascarids are probably more difficult than strongyles to cope with by these measures because of the extreme resistance to environmental factors exhibited by the ascarid larvae enclosed in their tough egg shells.

Treatment is also generally employed as a control procedure for ascarids. No known agent can be employed prophylactically against ascarids the way small doses of phenothiazine are used against strongyles. For the present then, treatment is limited to the administration of therapeutic doses. Carbon disulfide is used almost exclusively by practicing veterinarians in the central Kentucky region. Recently, however, new agents have been studied which show promise of improving ascarid therapy.

Carbon disulfide has been widely used, although it is a potentially dangerous and a comparatively drastic agent to administer. Using the liquid form and administering by stomach tube is the preferred method of dosing. This gives assurance that administration is proper and fractional dosing is feasible. In general, the dose of carbon disulfide is at the rate of 6 dr. (24 cc.) per 1,000 lb. body weight. For the younger age groups, the doses used in this area are: 8-12 cc. for eight-week-old sucklings; 12-16 cc. for 12-week-old sucklings; 16-22 cc. for 16-week-old sucklings; 16-24 cc. for weanlings (October to November), and yearlings (January to June). The range in the doses allows for the variations in size and general condition of animals at the respective ages. For weanlings that have not been treated as sucklings according to the foregoing schedule and where heavy infection is evident, the dose is at the lower limit of the indicated range to avoid undue reactions. The maximum dose of carbon disulfide is 30 cc. which is employed by some on mature animals.

Several measures should be followed to obtain the best results with carbon disulfide. Animals should be fasted prior to treatment because the presence of food material in the stomach interferes with the action of the drug. Weanlings and older animals should be fasted for 18 hours before, and for four hours after treatment, after which only light feed is allowed. Water should be available during the fasting period. Sucklings should be muzzled or removed from the mare for several hours before and for two hours after treatment, and the mare should be milked out prior to allowing the foal to nurse again. Constipated animals should not be treated and laxatives, particularly oils, should not be given with or immediately following treatment with carbon disulfide. In addition, it is generally not advisable to mix phenothiazine suspensions with carbon disulfide for simultaneous dosing, in view of the observation that the action of the latter is thereby impaired[27].

Several features, including the relatively toxic nature of carbon disulfide pointed out above, limit its suitability as an ascaricidal agent. The recommended fasting period before and after dosing is undesirable, and there is a tendency by many to shorten or neglect this procedure. The justification for this is to minimize the animal's reaction to treatment; however, somewhat less than maximum therapeutic action undoubtedly results, too. Finally, activity of carbon disulfide against immature ascarids is limited as pointed out by Todd[21]. Thus, room for improvement over carbon disulfide therapy for ascarids in the horse is evident in several respects.

In limited trials[27, 24], toluene appeared quite active in the removal of ascarids from the horse. Doses at the rate of 0.1 cc. per lb. body weight were 100% effective in fasted animals[27] but only about 50% effective in non-fasted animals[24]. In the latter study, 100% removal was approximated in animals on full feed by doubling (0.2 cc./lb. body weight) the dose

Fig. 3. Verminous aneurysm in a branch of the anterior mesenteric artery. Note the marked thickening of the arterial wall, and the immature *Strongylus vulgaris* in the thrombus formation.

rate. These reports also indicate that toluene is less toxic than carbon disulfide. The only reaction recorded was a transitory period of depression after treatment with toluene. This drug is, in addition, fully effective against both immature and mature ascarids[24]. Because of the rather large volume of the dose and the nature of the drug, administration by stomach tube appears most appropriate. To the best of the author's knowledge, toluene is not being used in the field for ascarid therapy at the present time.

The anthelmintic potentialities of the piperazine compounds have received considerable attention in the past few years. Quite recently one of these preparations, piperazine adipate, was reported as an efficient anthelmintic against the horse ascarid[25]. Single doses were given at the rate of 10 gm. per 100 lb. body weight administered in solution by stomach tube. No preliminary fasting was carried out, and no adverse effects attributable to the drug were observed. In addition to the activity against the ascarids, action against strongyles, particularly the small strongyles, was evident. Limited trials with the related piperazine compound, diethylcarbamazine acid citrate (caricide®[1] or hetrazan®[2]), also indicated significant activity against ascarids which is in agreement with the unpublished findings of the present author and associates. The promise offered by the piperazine compounds as anthelmintic agents in the horse is noted in; (1) low-grade toxicity, (2) adaptability to several methods of administration, (3) effectiveness in animals on full feed, and (4) range of species, including ascarids and strongyles, affected.

Studies by Todd[21] indicate that timing a series of treatments to coincide with the seasonal occurrence and development of ascarid infection will result in more effective control of these parasites. The schedule of therapy includes three treatments as sucklings at approximately 8, 12, and 16 weeks of age, another treatment during the fall months as weanlings, and one treatment during the late winter months as yearlings.

The first ascarid infections in foals in the central Kentucky area mature when the foals are about ten weeks of age; so the first treatment of sucklings at eight weeks is designed to remove the first ascarid infections just before they mature. Repeating treatment twice more at four-week intervals in the sucklings is calculated to remove succeeding infections before they mature. Treating again as weanlings and yearlings removes later infections which will tend to be lighter, but may serve as important sources of infections for succeeding crops of foals.

The occasional ascarid infections in mares ordinarily are not treated separately. These will be removed when the mares are treated for bots, because carbon disulfide is the drug of choice for removing bots from horses.

Bots

Bots are not worms, but this discussion would seem incomplete without including these forms. Bots are common, important parasites of horses. In addition to the annoyance by the flies, young bots injure the tongue and mouth tissues by their migrations, mature bots produce deep pits at the points of attachment on the stomach wall, and clusters of the latter at the pylorus impede the passage of ingesta. Occasionally, serious damage is caused by bots going astray and locating in abnormal organs or tissues. Instances of aberrant locations include the bile duct, brain, nasal sinuses, peritoneal cavity, and ovary. The last is the unpublished finding of the author and associates on a Thoroughbred mare whose ovary contained a large cyst in which a mature third instar *Gastrophilus intestinalis* was found.

Measures for bot control include removal of the eggs on the hairs by clipping, artificial hatching (common bot) by warm water washes, and treatment. Timing of treatment for the removal of the bots from the stomach is one of the most important considerations for effective control. Treatment at any time during the year stands to remove bots because

®[1]Lederle Laboratories Div., Pearl River, N. Y.

some are present in the stomach of most horses the year around. Treatment about a month after the first killing frost, which is late November or December in Kentucky, has been recommended for a number of years and is a sound practice because infections are generally heavy at this time. However, many bots, particularly the common bot, will arrive in the stomach after this late fall treatment. Second stage larvae of the common bot are found in appreciable numbers during January and February. Delaying or repeating treatment in February would remove the later infections. The time of the later treatment must be conditioned by the foaling date of mares, because carbon disulfide should not be given within 30 days of foaling.

Stomach Worms

There are three species of large stomach worms *(Habronema spp.)* which occur in horses and are capable of producing severe gastritis. These worms are intimately associated with the gastric mucosa, one species resulting in tumor-like abscesses. Flies are required as intermediate hosts for transmission. The presence of these worms is not ordinarily detected by floatation examinations of the feces, because the embryonated eggs do not float readily. When stomach worms are suspected, special technics have been suggested which are cumbersome, and are dependent on examining gastric fluid obtained by lavage, or utilizing fly maggots to find the eggs in the feces[19]. Due to the difficulty of diagnosis, the significance of these forms probably tends to be minimized. Fortunately, however, carbon disulfide effectively removes them[12] and the use of this drug for ascarid and bot control also serves to control the large stomach worms. Phenothiazine is not active[10, 18], while the more recent anthelmintics, toluene and the piperazine compounds, have not been evaluated in this respect. Measures directed at fly control also aid in controlling these worms.

In addition to infecting the horse, the minute stomach worm *(Trichostrongylus axei)* is a common parasite of cattle and sheep. Although the cross-transmission between these three hosts is not well understood, recent investigations[6] indicate that *T. axei* can be readily transmitted from the horse to cattle and sheep, both directly and indirectly, and from sheep back to the horse. Young horses are apparently more susceptible[18], but older horses may be infected. Heavy infections may cause a rapid loss of condition associated with an extensive and severe catarrhal gastritis[1]. The presence of this species can be determined by differentiating its characteristic egg, which is pointed at one end and flat on one side, from the generally larger, symmetrical strongyle eggs, or its short-tailed infective larva from the long-tailed strongyle larvae. *T. axei* is a relatively poor egg-layer and the number of eggs or larvae found in the feces may be misleading as an index of the gastritis present. Although the early work of Taylor and Sanderson[20] is not in agreement, more recent reports[10, 18] indicate therapeutic doses of phenothiazine will effectively remove this species from the horse.

Fig. 4. A heavy bot infection (664 *Gastrophilus intestinalis* and 454 *G. nasalis*) in the stomach of a mare that presented a marked hemorrhagic gastritis and a six-inch tear along the greater curvature at necropsy. Typical clusters of these bots are located bottom center and right center respectively.

The low-level system of administration has not been evaluated in this respect, but it probably functions in reducing the transmission of *T. axei*. Carbon disulfide may also be effective against this species[35].

Pinworms

Pinworms *(Oxyuris equi)* are usually associated with irritation produced by the activity of the adult female worms in the perineal region, particularly in the younger age groups of horses. However, heavy infections of immature pinworms may be found in older animals[6, 41] and by their characteristic feeding habits[41] may cause more injury to the mucosa of the dorsal colon than is generally recognized. There is no entirely satisfactory agent for the removal of pinworms, although a number of compounds have been studied. Oil of chenopodium and oil of turpentine have been recommended as effective, but the treatment procedures are comparatively rigorous. Therapeutic doses of phenothiazine will remove some pinworms and is recorded as more effective against the immature forms than the mature worms[7]. Enemas will remove some of these parasites, and symptomatic treatment of the perineal irritation is indicated. Promise of improved therapy is forecast by the activity found in the piperazine compounds against pinworms in other hosts.

Intestinal Threadworms

Foals are commonly infected with the small intestinal threadworm *(Strongyloides westeri)*. Little is known of the actual effects of this worm on foals other than the association of diarrhea with infection and the self-limiting aspects in which infection disappears by the time foals are six months of age[34, 37]. No effective treatment is known; so control is dependent on sanitation. Clean, dry bedding is essential, with daily changing indicated.

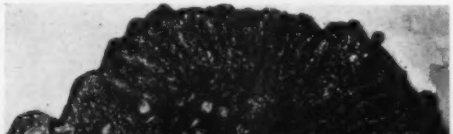

Fig. 5. Portion of the cecal wall of a horse showing a light tapeworm *(Anoplocephela perfoliata)* infection cluster around the ileo-cecal valve.

Tapeworms

Of the three species of tapeworms parasitizing horses, the one *(Anoplocephela perfoliata)* previously recognized[15, 21, 25] as the most uncommon in this country is the only species observed in central Kentucky horses at the present time. The explanation for this apparent difference or change in the occurrence of these species is not known; however, it is of interest because *A. perfoliata* is probably the most pathogenic of the three species. This is due to the tendency of *A. perfoliata* to form clusters at the ileo-cecal valve region of the cecum and produce ulcerative lesions, which may become granulomatous or lead to perforation. Diagnosis of tapeworm infection can be made by demonstrating the eggs on ordinary floatation examination of feces, although in light infections several examinations may be required before eggs can be found. In the experience of the writer, the incidence of *A. perfoliata* infection in central Kentucky horses is low and the infections characteristically light. Treatment is not ordinarily suggested, primarily because of the lack of a suitable drug. Among the various tapeworm treatments, oil of turpentine, areca nut, kamala, and oleoresin of male fern have been recommended[20, 25].

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New Enzyme Test for Glycosuria

A book of enzyme-impregnated test papers, not dissimilar from the large paper matches, has been designed by the Ames Company, Inc., Elkhart, Indiana. These reagent strips, called clinistix® serve for specific test for urine glucose. They provide the utmost simplicity and convenience and are claimed to be extremely sensitive and qualitatively accurate.

Simple instructions for use include dipping the test end of the strip in a sample of urine or placing a drop on the sensitized end. A positive reaction is change from near colorless to blue. Unchanged color is interpreted as negative.

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During the recent annual meeting of the Georgia Veterinary Medical Association official action was taken to oppose the widely publicized "directive" of Secretary of Defense Charles E. Wilson regarding abandonment of the Veterinary Corps of the Army and Air Force.

Dr. C. C. von Gremp, Decatur, is the newly elected president of this group. Dr. L. A. Mosher, Lowell, and Charles C. Rife, Atlanta, were elected president-elect and secretary-treasurer respectively.

Mucosal Disease Of Deer†

S. H. RICHARDS,* B.S., I. A. SCHIPPER,** M.S., D.V.M., D. F. EVELETH,§ Ph.D., D.V.M., and R. F. SHUMARD,§§ Ph.D., Fargo, North Dakota

RECENT publications by numerous investigators have described mucosal diseases of cattle. First reported in New York state[1] and later in Iowa,[2] Indiana,[3] North Dakota,[4] Colorado,[5] California[6] and elsewhere in the United States and Canada these diseases are characterized by overlapping symptomatology and pathology. Mucosal diseases affect young animals, primarily those up to 18 months of age, although all age groups have been included. Symptoms may include all or any combinations of the following: Anorexia, dehydration, profuse lacrimination, and purulent mucoid nasal discharges, diarrhea, and lameness. Prominent lesions exhibited are catarrhal, ulcerative, or hemorrhagic inflammation of the mucosal surfaces of the body. Many animals have exhibited parasitic infections as well.

In 1954, Guenther[7] (unpublished) reported on an epizootic in whitetailed deer that occurred in eastern Washington in 1946 and 1953. Shope, MacNamara, and Mangold[8] described conditions that existed in the New Jersey deer herd in the summer of 1955. Fay and Boyce[9] presented a paper at the 17th Midwest Wildlife Conference on a deer epizootic that occurred in Michigan during the summer of 1955. Descriptions of the pathology observed in carcasses from these epizootics differ from those for the mucosal diseases in some respects and are similar in others.

It should be stated here that the term mucosal disease as it relates to deer is used in the broad sense and may include any of those new cattle diseases that affect the mucosae of the body. Mucosal disease will be used in the abbreviated form (MD) whenever possible.

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Symptomatology

During the spring and summer of 1955, several deer were found sick or dead in various parts of North Dakota. Both the mule deer, *Odocoileus hemionus,* and the whitetailed deer, *Odocoileus virginianus* (WTD), were involved. Some of the animals were thin and depressed while others were visibly sick but in excellent condition. Most of these were young animals of not more than 18 months of age. Two of the early cases included a 273-lb. WTD more than three years of age, and a 198-lb. mule deer which was at least two years of age. Both of these animals were in excellent flesh. The WTD was found a few minutes after death and the mule deer was captured alive, observed, killed, and examined.

Other deer found alive exhibited weakness, lack of wariness towards man, impaired hearing and vision, dehydration, and emaciation. In all cases no other external symptoms, typical for cattle, such as excessive salivation, stringy nasal discharge, crusty nose or hyperkeratosis were observed. One mule deer had a corneal opacity which resulted in blindness in one eye and impaired vision in the other. Lacrimation was present. Bloody mucus in the feces was seen in several deer. The stools were of a soft consistency and shape similar to loose feces of cattle. In others the droppings, though normal in shape, were held together into balls by a thick stringy mucus that was flecked with blood.

Three deer were observed before they died. All were found close to or in water. They were moving nervously about and throwing their head back over their shoulders in a circular motion. These three deer were found at widely separated points in the state.

General Necropsy

Postmortem examination revealed several types of lesions that coincide with those found in cattle. The severity of inflammation was most pronounced in deer that had been in good condition just a few days previously as in-

dicated by their weights and general appearance. Those animals that exhibited emaciation and weakness seldom showed the severe inflammation. Presumably they were partially recovered cases.

The following descriptions are of lesions revealed at necropsy in 16 WTD and three mule deer found dead at various localities throughout the state. Others used for experimental purposes will be described separately in detail.

Head Lesions. Examination of the head revealed an absence of erosions, ulcerations or hemorrhages of the oral mucosa — tongue, dental pads, palates, or lips. Turbinates were hyperemic and darkened on the anterior portion in all cases. Petechial hemorrhages often accompanied the hyperemia. Clotted blood and mucus filled the nasal cavities. Hemorrhages in the pharynx varied from petechial to ecchymotic while the frontal sinuses had only the former.

Respiratory Tract. Petechial to diffuse hemorrhages were present in the larynges of a few deer. The remainder were normal. The trachea showed variations in condition from a fiery red hyperemia to normal. Sometimes only a few petechial hemorrhages were scattered throughout. Erosions were seen in one mule deer. There was some congestion in the lungs of only the most severe cases. The rest appeared normal.

Gastrointestinal Tract. Catarrhal, ulcerative and/or hemorrhagic inflammation of the gastrointestinal tract appeared in most of the wild animals examined. The rumen and omasum revealed little or no inflammation. Severe gastritis was seen in the abomasum of most cases. Erosions or ulcerations were present in the pyloric region in greatest numbers although they were lightly scattered in the fundus of some of the severe cases. These varied from small, grayish white, slightly raised areas with darkened centers to long (1-3 cm.) blackened necrotic areas. Frequently there was a tenacious slime that adhered to the mucosal wall and some of the ingesta present. Sometimes the ulcerations were surrounded by petechial hemorrhages. In several of the deer examined during the summer of 1955, no ulcerations were apparent. They were noted, however, during late 1955 and early 1956.

A brownish red catarrhal enteritis, which varied in severity with each animal, was present in the small intestines of all deer examined. In severe cases, small ulcerations were scattered throughout. Many times the mucosal tissue had eroded away so that only the muscle wall remained with a thickness and appearance of cellophane. Generally hemorrhage and necrosis were most pronounced in the duodenum and jejunum and decreased in severity in the ileum, cecum, colon, and rectum. Except for a few cases examined during the winter where weakness and emaciation were apparent, few of the deer showed severe hemorrhage or necrosis in the rectal region. Dilitation of the submucous glands adjacent to the ileocecal valve and diffuse hemorrhages of the cecum were most common. Ulcerations were present in about 10% of those examined. The colon and rectum often was mildly hemorrhagic.

Other Organs. Hemorrhages on the epicardial surfaces of the heart were noted in a few cases. A mild to severe cystitis was present in the bladder of all deer examined. There were ulcers on the bladder of a few cases. Inflammation of the kidneys was observed sometimes. Necrosis was observed on one lobe of the liver of a WTD; all the rest had normal livers. One WTD had numerous small dermal hemorrhages in the abdominal region. There was edema of the brain tissue of the deer, antelope, and cattle exhibiting symptoms of this disease.

Bacteriological and Parasitological Examination. Several of the deer were obtained before or shortly after death. Cultures were made of the liver, spleen, lymph nodes, and brain, using aerobic and anaerobic media. Blood smears were negative for anaplasma. Brain tissue was negative for Negri bodies. A Pasteurella organism was obtained from two cases, but it was not considered significant in the light of lesions present. The rest were negative for bacteria of any consequence. Mild to severe coccidial Eimeria sp. infections were noted in many.

Experimental Transmission

Transmission studies to determine the nature of the killing agent have been conducted and are continuing. Transmission from deer to deer, and deer to antelope, with infected deer spleen or blood inoculum has been accomplished. Cattle to deer transmission using spleen material from cattle that died with mucosal disease has been successful. All of the material: Spleen inoculum or whole blood taken from deer and cattle was bacterial free before it was injected into test animals. The results from both of these different sources have produced identical symptomatology and pathology.

Deer to Deer. Two transmissions from a mule deer to WTD have been tried and were successful. Whole blood was used in one, a doe;

and spleen inoculum in a buck. The source of this material was a sick and partially blind mule deer buck that was captured alive, placed under observation, bled, and then destroyed. A corneal opacity was present in both eyes that resulted in blindness in one eye and partial vision for the other. Lacrimation was present in both eyes.

Typical lesions for the head, respiratory and gastrointestinal tracts that coincide with the general necropsy were noted in this animal. The abomasum had only the small grayish white ulcerations present. A large ulcer adjacent to the ileocecal valve was observed. Cystitis was severe.

A WTD buck was given a 20 ml. dose of a 50% saline spleen inoculum intramuscularly on November 15, 1955. It developed anorexia, depression, lameness, and soreness of the flanks on December 1, 1955. During the following four days the deer had a severe diarrhea that contained mucus and was flecked with blood. This diarrhea produced a dehydrated emaciated condition. The animal spent most of the time lying down with its head and neck stretched out on the ground. When walking the deer licked its hocks, flank, back, and abdomen on numerous occasions and continually ran its tongue over its nose.

There was no excessive salivation, lacrimation, crusty nose or, stringy nasal discharge observed during illness. Defecation was painful and produced either a diarrhea or severe straining. With the diarrhea and later with the normal droppings there was an adhesive slimy mucus. As the buck partially recovered, mucus persisted and held feces in tight balls. A pronounced cough developed during the period of diarrhea and continued until death. Weight loss incurred at this time was never recovered. Death occurred 100 days after injection.

Autopsy revealed conditions similar to those covered under general necropsy. Typical lesions, classified as severe, were noted in the head region, respiratory and gastrointestinal tracts. The left lung was congested. Some necrosis and sloughing were present in parts of the intestines giving a cellophane appearance to those areas. A cystitis with ulcers was noted in the bladder.

A WTD doe given 20 ml. of blood from the mule deer failed to develop any diarrhea. It licked its nose excessively during the first three weeks following injection. There was a lameness, soreness of the flank and abdomen and reduction in food intake for a two month period. From the time of injection until 175 days later, there was a progressive weight loss, roughening of the coat, which resulted in a stunted, scrubby appearance.

Deer to Antelope. One female antelope, *Antilocapra americana,* was given 20 ml. of a blood and spleen inoculum intramuscularly from the sick mule deer on Nov. 15, 1955. Eleven days following injection this animal became depressed and lay with its head stretched out on the floor of the stall. The nose was hot and evidently irritated since the antelope licked and rubbed it continually. There was no increase in temperature as it remained within the normal range of 102-102.9 F. On January 12, 1956, symptoms reappeared. An abscess at the point of injection ruptured and spread over the hind legs. Three days later the antelope had apparently recovered. From the time of the first depression the animal gradually lost weight until it was killed and examined on April 9.

Lesions revealed were similar to those described for deer except that they were milder. Cholecystitis and cholangitis were present and the bile was darkened and thickened. A mild cystitis and a thickened urinary bladder wall were noted.

Cattle to Deer. A male fawn WTD was given 20 ml. of a 50% saline spleen inoculum from a Hereford steer that had died of mucosal disease. The date of injection was August 31, 1955. Eleven days postinjection, this fawn exhibited depression, anorexia and a lameness of the right rear leg. It licked its nose continually, running the tongue over not only the tip but as far posterior as possible. This condition persisted for nine days after which the condition gradually returned to normal. There was a gradual weight loss until death 67 days after injection.

Postmortem examination revealed lesions similar to several of the deer found dead in the wild. Typical conditions for the turbinates, sinuses, pharynx, larynx, trachea, and urinary system were noted. Examination of gastrointestinal tract revealed lesions that were moderate. There was a mild lung congestion. Gastritis was moderate; ulcerations were absent. Submucous glands at the ileocecal valve were edematous and darkened.

A mule deer buck was placed in a pen that had previously been occupied by a steer suffering mucosal disease. The same watering container and hay contaminated with feces, urine and saliva were left in the stall. Twenty-four days following confinement in this stall the animal became ill, depressed, salivated profusely, defecated with difficulty, and died.

Symptoms were pronounced for approximately two hours.

Necropsy revealed severe inflammation throughout most of the mucosal lining. Lesions were more pronounced in this deer than all others examined. The larynx and trachea were inflamed intensely with scattered petechiation. Mucus was present in the trachea.

The gastrointestinal tract was inflamed. Gastritis was pronounced but ulceration absent. There were numerous petechial hemorrhages of the omasum and a few on the pillars of the rumen. Lesions of the intestines, cecum, and rectum coincided with those covered under general necropsy.

A large two-year-old WTD doe was given 20 cc. of a 50% saline mucosal spleen inoculum from a Hereford cow on February 16, 1956. The doe displayed depression, anorexia, and tenderness of the flanks and abdomen on February 26. This condition continued for five days. Feces, while retaining their natural shape were compressed together into a mass. Pellets were of a soft consistency and were held together by a small amount of mucus. The feces remained this way for approximately three weeks before returning to their normal form and size. The deer was killed and examined on April 6, 1956.

At postmortem examination the same lesions observed in the other deer prevailed and coincided with the general necropsy description with one major exception. There was moderate inflammation throughout except in the cecum where catarrhal, ulcerative, and hemorrhagic inflammation were noted. Diffuse hemorrhages were present in the colon and rectum.

Discussion

A stringy mucoid nasal discharge and lacrimation with erosion around the eyes are the outstanding symptoms of mucosal disease in cattle. These are seldom observed in deer. As a result no association had been made between the new diseases occurring in cattle and deer. Other characteristics of mucosal disease such as a pronounced watery diarrhea, hyperkeratosis, and a crusted nose sometimes present in cattle have not been observed in wild ruminants.

Symptoms observed in cattle such as staggering, lameness, tenderness of the flanks and abdomen, cough, depression, anorexia, and straining were noted in the wild deer before they died. Such manifestations as agressiveness and corneal opacity were observed in one case each but these were rare. Blood in the feces was noted in both WTD and mule deer.

Oral lesions so typical for cattle, were absent in all of the wild animals examined. Hemorrhages, ulcers or erosions, present on the tongue, palates and dental pads of cattle were not seen in any deer either wild or experimental. Erosions of the mucosal linings of the body were much more prominent in cattle. Pseudomembranes on the intestinal mucosa were noted in only one deer. Enteritis was most acute in the duodenum and jejunum and diminished in severity in the ileum, cecum, colon, and rectum. Conversely in cattle the ileum, cecum, colon, and rectum are most severely affected.

Similarity of lesions are numerous. Hyperemia and hemorrhages that varied from petechial to ecchymotic were found in the turbinates, sinuses, and pharynx of both ruminants. Tracheitis and laryngitis varied with the individual animal. Catarrhal, ulcerative and/or hemorrhagic inflammation of the abomasum present in both mule deer and WTD varied with the individual rather than the species. In most of the deer, the rumen and omasum appeared normal. In one or two severe cases there was inflammation of the omasum and petechial hemorrhages of the pillars of the rumen. Catarrhal enteritis was present in every case examined and ulcerations were found with enteritis in severe cases. In several instances, the small intestine was eroded so badly that only the outer wall remained.

Cystitis, and thickening of the urinary bladder was noted frequently. One bladder of a WTD had a severe cystitis and ulcerations. Petechial hemorrhages were noted on the epicardial surfaces of the heart of a few wild life specimens taken during the winter of 1956. 1956.

Experimental transmission of MD from cattle to deer produced the same symptoms and lesions as were observed in sick or dead deer found during 1955-56. Mucosal diseases which produced nasal discharge, salivation, lacrimation, and diarrhea in cattle failed to produce these symptoms in deer. Both cattle and the experimental deer exhibiting acute symptoms were prone to lie with the neck and head stretched out on the ground. This behavior has been described for cattle suffering from rhinotracheitis.

Deer infected with cattle MD failed to produce any oral lesions. This may be due to the deer having a tougher oral mucosa than cattle. Since their normal food, which is browse, is much harsher than grasses they would need

a more resistant lining. The deer's respiratory mucosa is similar to that of cattle and is affected accordingly.

The variation in the catarrhal, ulcerative and hemorrhagic inflammation found in the experimental deer coincides with similar findings in wild deer and cattle. Ulceration was present only in those cases where partial recovery was followed by a dormant period before death. Emaciation, malnutrition and a stunted growth were manifestations of this period. The length of this latent period is probably inversely proportional to the amount of damage done to the intestinal lining. These studies have shown that a long period can elapse between the time of infection and death of the animal.

The presence of a Pasteurella organism in two of the deer was not considered significant in the light of the results of the transmission studies. Pasteurella-like organisms were present in the ill, partly blind mule deer from which the inoculum was produced. Yet when the spleen inoculum was made bacteria free and transmitted to deer and antelope, original symptoms and lesions were produced in test animals. This indicated that some other factor was responsible. Cholecystitis and cholangitis, in conjunction with a darkened tenacious bile, are typical lesions of mucosal disease in cattle. These are atypical for hemorrhagic septicemia and shipping fever. They were produced in the antelope with the deer inoculum. The absence of a gall bladder in deer prevented comparisons with cattle.

Transmission studies from deer to cattle have been attempted but the results are indefinite and will be reported at a later date.

Summary and Conclusions

A disease of white-tailed deer (WTD) and mule deer with lesions and inflammation similar to mucosal disease of cattle has been observed. Both WTD and mule deer have been necropsied and found to contain catarrhal, ulcerative, and hemorrhagic inflammation of the mucosal linings of the body. Symptomatology and behavior of sick deer is similar in many respects and different in others to MD of cattle. Experimental transmission from deer to deer, deer to antelope, and mucosal disease of cattle to deer produced similar symptoms and lesions. Further studies on etiology, infectiveness, and transmission will be conducted.

The authors wish to thank those members of the Game and Fish Department who assisted in obtaining diseased deer.

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Honor Dr. Norman Miller

Dr. Norman J. Miller, Eaton, Colorado was presented the Florence R. Sabin Award for outstanding contributions to public health.

Doctor Miller's activities have extended beyond those concerned with his extensive practice. His service to his community and state is a record of profound interest in public health and welfare. He served in the School Board, Town Council, and as mayor of Eaton. Later he was elected to the Colorado House of Representatives, where he served for three consecutive terms. Since 1950, he has served continuously as Senator for the Seventh Senatorial District of his home state. During this period, Doctor Miller has been active in all matters pertaining to public health and education and in drafting suitable legislation out of which has evolved a model State Department of Public Health.

Doctor Miller was recipient of the A.V.-M.A. Award in 1954, which cited his work as a member of the Colorado Postwar Public Health Planning Committee.

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Moose Need Browse (Brush and Twigs)

According to Dr. B. I. Love, Superintendent of the Elk Island National Park in Alberta, moose fed conventional roughages like legume hay will die within a year or so unless they have access to browse.

Keratoconjunctivitis In Turkeys: A Preliminary Report

BERT W. BIERER,* D.V.M., Columbia, South Carolina

A DISEASE characterized by inflammation of the eyelids and in the more advanced stages an ulceration of the anterior portion of the eyeball has appeared in turkey flocks during the past three or four years. What appears to be a description of the disease was published in January 1953 as an inquiry from the laity[1]. During this same winter a number of birds from several affected flocks were examined and, on the basis of routine examinations and the simultaneous appearance of fowl pox in one of the flocks, it was concluded that the disease in question was pox involvement of the eye[2]. Subsequent developments, however, indicate that fowl pox may not necessarily be a part of the disease entity under consideration.

Incidence and Gross Appearance

Keratoconjunctivitis is a disease of adult turkeys that usually appears in so-called early breeder flocks. Such flocks are in egg production during the months of November, December, and January and are exposed to artificial light for the purpose of stimulating egg production. While hens are the usual victims, only toms were affected in one outbreak. Birds on certain premises appear to be affected more than birds on other farms. Late breeder flocks, which come into production during the spring of the year, are usually not affected.

The first evidence of keratoconjunctivitis is a whitish foam at the inner corner of the eye near the nictitating membrane. One or both eyes may be affected. Some report observing a whitish crust on a fold of the outer surface of the eyelid. After the bird begins to rub the affected eye on its feathers, a small amount of discharge develops. The conjunctiva becomes progressively more inflamed, other birds peck the eye, cheesy matter appears, and the lids become encrusted and stick together preventing vision from the affected eye.

While the early stages are essentially characterized by the presence of a conjunctivitis and a cheesy exudate, the later stages (if recovery has not resulted from isolation and treatment) are essentially an ulceration of the cornea that terminates in destruction of the cornea, loss of aqueous humor from the anterior chamber, and permanent blindness.

Economic Loss High

Keratoconjunctivitis is a disease of considerable economic importance. A turkey breeder-hatchery establishment maintaining a flock of 1,000 to 2,000 breeders has estimated an economic loss of $5,000. to $10,000. during a single breeding season, from the following causes:

1. Loss of health of affected birds due to blindness and inability to obtain adequate feed and water.

2. Loss of egg production resulting from the isolation and treatment of affected hens. Birds showing evidence of the disease and retained in the flock continue to lay unless blindness occurs.

3. Affected toms become shy, even if only one eye is involved, and mate less frequently. Consequently, decreased fertility and hatchability of eggs produced occurs. One flock owner, for example, reported that approximately 75% of his toms were affected, resulting in a drastic lowering of egg fertility.

Morbidity and Mortality

While mortality resulting from keratoconjunctivitis is negligible, the number of animals affected varies from an insignificant amount in some flocks to 35 to 40% of the members of a severely affected flock. As already indicated, however, the greatest economic loss may occur if the toms, which only constitute about 10% of a flock, are predominantly affected.

Etiology Obscure

The cause of keratoconjunctivitis has not been established. A number of channels, however, merit investigation.

1. The infection theory is certainly of basic consideration. Bacteria of the Hemophilus

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group are associated with so-called pink-eye of cattle[3] and roup or head colds of poultry[4] and conjunctivitis in man[5]. A member of the Rickettsia has been described as the cause of an infectious keratitis in sheep. The pleuropneumonia-like organism of infectious sinusitis, a common disease in turkeys, has been reported as responsible for the presence of foamy or frothy whitish matter in the eye during the initial infection phase. Numerous other bacteria and microorganisms are associated with eye infections[6]. More recently a salmonellosis has been definitely established as the cause of blindness in chicks[12]. Along these lines it should be mentioned that for a number of years it has been known that individual cases of blindness in chickens and turkeys were associated with Salmonella and Arizona paracolon microorganisms.

Fowl pox virus is theoretically a likely cause of keratoconjunctivitis. The eye is the last portion of the body to become immune to pox after vaccination and is the first portion of the body to become susceptible as immunity wanes[3]. Experimental work conducted thus far indicates that the pox virus is not associated with keratoconjunctivitis. In eye pox there are usually a few of the affected members who present typical pox lesions in the mouth or typical scab lesions on the head.

Diseased tissue removed from birds affected with keratoconjunctivitis fails to reproduce pox or any other disease when such tissue has been ground in saline and vigorously brushed into the conjunctival sac or inoculated through the eyelids of poults. It is acknowledged, however, that in transmission experiments conducted thus far only the lesions from chronic stages have been used and only young turkeys have been subjected to the attempted transmission. On the other hand, poults should be more susceptible to fowl pox infection than adult birds.

Aspergillosis of the eye has been reported as producing a similar syndrone[7] but the occurrence of aspergillosis is not restricted to the circumstances ordinarily indicated for the appearance of keratoconjunctivitis. Aspergillosis, of course, has not yet been eliminated as a cause. Initial attempts to isolate an etiological agent by routine bacteriological procedures have resulted in the isolation of staphylococci and streptococci bacteria. Such organisms are presently considered to be secondary invaders.

2. The nutritional theory like the infection theory deserves a thorough consideration. Keratoconjunctivitis appears during the colder months of the year when nutritional deficiencies are most apt to appear. In addition, the disease only appears in flocks under the stimulating influence of artificial lighting, which results in a heavy demand for an uninterrupted and balanced supply of nutrients. The demand for nutrients is twofold. (a) To maintain body condition and health under the adversities of cold weather and chilling rains, and (b) to produce eggs which contain all of the nutrients necessary for the production of healthy, vigorous poults.

Vitamin A deficiency or nutritional roup results in a similar eye disease[9]. Sinus involvement, not seen in keratoconjunctivitis, is seen in typical vitamin A deficiency of adult birds. Pantothenic acid deficiency can result in a conjunctivitis and sticking of the eyelids[9] and is thus a possible cause or factor contributing to the occurrence of keratoconjunctivitis.

3. The mechanical theory embraces the idea that the artificial lights used on breeder flocks, during the months of the year when the light of day is short, results in an irritation of the conjunctiva and thus results in the disease described. Light, together with air, feed, and water, is one of the basic forces contributing to the existence of all life and consequently exerts a dynamic influence on all living matter. The intensity of the artificial light and the manner that such light is used can certainly be a significant predisposing factor. Severe outbreaks of keratoconjunctivitis have been observed only in flocks under artificial lighting, keeping in mind that numerous flocks under such lighting have not been troubled by the disease. In addition to light, other mechanical factors may be involved. Ammonia fumes, for example, have been found to be the cause of conjunctivitis in birds kept in tightly closed houses[13], and baby chicks and poults are reported as being permanently blinded by germicidal lamps used in the incubators, resulting from an improper adjustment of such lamps. A severe conjunctivitis has been reported in baby chicks attributed to the use of box tops as feeders[14].

4. The parasitic theory recognizes the fact that Manson's eye worm *(Oxyspirura mansoni)* can produce a disease clinically indistinguishable from keratoconjunctivitis. Experimentally, however, chickens have been infected with large numbers of eye worms[10] with little or no ill effects. Eye-worm disease in the United States is supposed to be confined to areas in Florida and Louisiana because its transmission is dependent upon the limited geographical distribution of the burring coachroach *Pycnoscelus surinamensis.* Many different kinds of

parasites can be associated with eye infections. In fact, one authority wrote a lengthy report on the subject over 50 years ago[8, 11].

Treatment

Some of the birds which are promptly isolated in the early stages of the disease recover without treatment. Other turkeys require that the cheesy matter be removed from the eye. Local treatment with sulfathiazole ointment or the antibiotic ointments has been reported as exerting a remarkable healing effect. Birds in the advanced stages of ulceration of the cornea, however, are permanently blind due to the destruction of tissues vital to the normal functioning of the eyeball.

There is some question among flock owners, considering the time and labor involved, as to whether or not local treatment is practical even though it may be successful. The advisability of resorting to local treatment thus depends upon the size and set-up of any particular turkey-breeder establishment.

The use of antibiotics and nitrofurans in the feed at treatment levels seems to be helpful as a flock treatment. This beneficial effect can possibly be due to the control of secondary eye infections.

Summary

A disease of turkeys named keratoconjunctivitis has been described. The disease usually appears in adult breeder flocks on range which are being exposed to artificial lighting during the months of November, December, and January. The etiology of the disease is obscure.

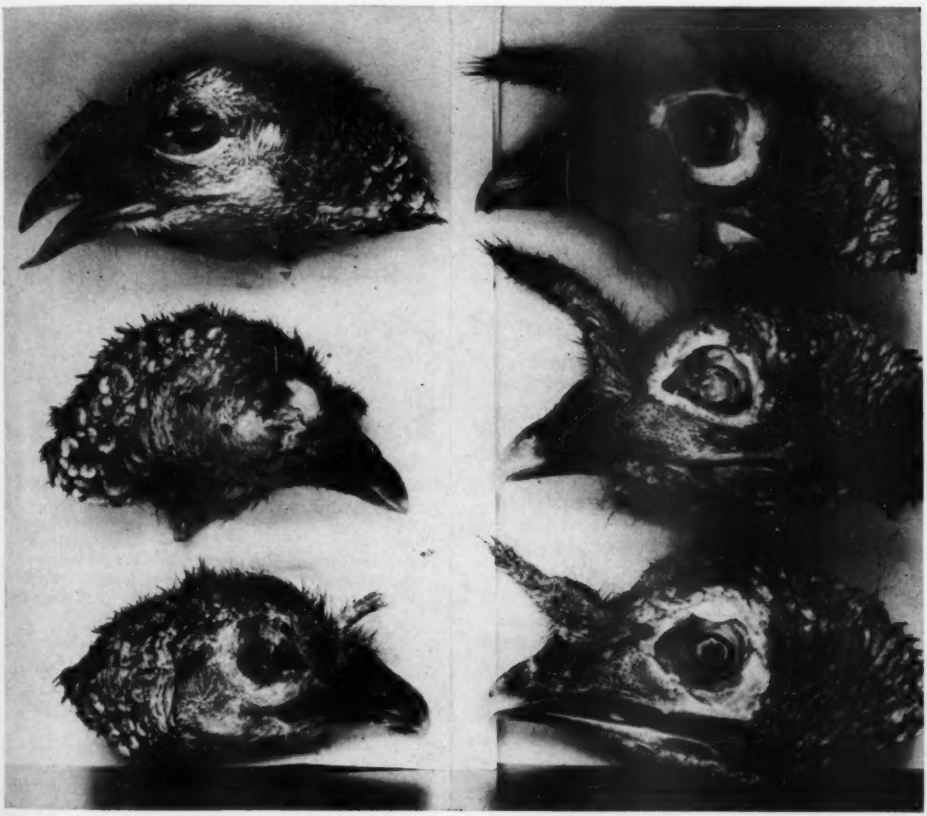

Fig. 1. Left: (upper) Demonstrating the presence of a severe conjunctivitis. (middle) Illustrating thickened eyelids and the conjunctival sac filled with cheesy matter. (lower) Eyelids removed to show the presence of the cheesy matter.
Right: (upper) Revealing ulceration of the cornea, eyelids removed. (middle and lower) Demonstrating the presence of a severe keratitis with extensive destruction of corneal tissue, eyelids removed.

Individual treatment, while often successful, is of questionable practical value.

Losses in body weight, productivity, fertility, and hatchability, may be responsible for an estimated loss of $5,000. to $10,000. in a single flock during a single breeding season.

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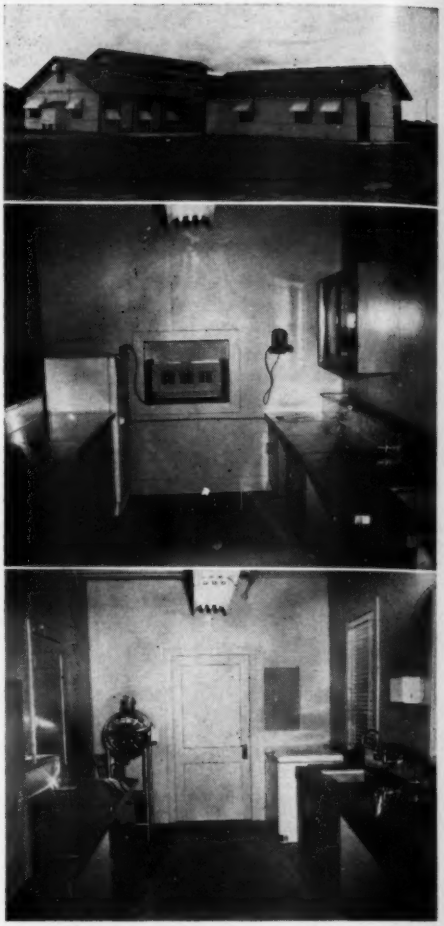
New Virus Research Laboratory at Texas A. & M. College

The group of pictures on this page were supplied by Dr. John Delaplane, head of the Department of Veterinary Bacteriology and Hygiene and illustrate new facilities made available on the campus of Texas A. & M. College primarily for the purpose of research on ornithosis. Funds for construction were obtained under the stimulus of pressure resulting from outbreaks of ornithosis in turkeys in the Southwest and elsewhere. They will provide the necessary facilities in which to carry on the extensive research program already under way.



Top: View of laboratory section (right) and the wing housing the isolation units. A breezeway connects the two sections. The designers felt that this type construction offered security in that only normal access to the building is through the dressing and shower rooms. Each animal room is equipped with room ventilation. Hoods over windows are air filters over intake ducts. Air is exhausted through the attic portion of the building in such a manner that it is discharged several feet away from the building.

Center: Virus laboratory. All fixtures throughout are stainless steel.

Lower: Sterilization, storage and media preparation room.

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Ascending infections originating as vulvitis, vaginitis, or cervicitis, account for more bovine infertility than all other causes, except vibriosis, according to Dr. W. H. Haubrick*.

*Haubrick, W. H., Bovine Infertility. *Cornell Vet.*, 45:304 (July), 1955.

Advances Made In Swine Practice

H. C. SMITH,* D.V.M., Sioux City, Iowa

Part VIII: Listeriosis

THE incidence of porcine listeriosis has increased during the past few years. Previously unsuspected reservoirs of infection are being reported in veterinary literature. Because the diseases of swine involving the central nervous system are becoming so numerous, the diagnostic judgment of the veterinarian is taxed, and, unless practitioners keep abreast of available diagnostic methods, confusion of nervous diseases may result.

Listeriosis is one of the diseases of swine which may be primary and which also may be secondary to almost any primary disease. It is a specific infectious disease of swine, due to the *Listeria monocytogenes,* a Gram-positive organism which is isolated usually from the brain of infected pigs.

The disease has been reported to occur in cattle, sheep, horses, dogs, goats, rabbits, foxes, chickens, gerbilles, chinchillas, ferrets, cats, mink, and man. It is not known how the disease is transmitted from one animal to another. It does not occur as an explosive type of infection in a drove of swine, nor does it affect all animals in a herd.

Early Experimental Work

In 1930, Robert Graham *et al.*[1] inoculated a one-month-old pig intravenously with a saline culture of Listerella (as the organism was then known) obtained from sheep. A temperature response existing for two days was reported. During this period, the animal exhibited marked depression. Eventual recovery ensued. Another pig, inoculated in the same manner, developed a body temperature of 104 to 105.4 F. for two days, which then fell to normal and to below normal for three days before its death. Posterior paralysis was observed for several days. The pig died nine days postinoculation. Listerella was recovered from the heart blood and the medulla. Conjunctival exposure was followed by death in two pigs from which the identical organism was isolated.

The first human case of Listeria was reported in 1936 by C. G. Burn[2]. Between 1936 and 1948 there were 23 cases of which 13 were diagnosed as meningitis. The part played by animals as a reservoir of infection for human beings is not fully understood.

Biester and Schwarte[3] reported that swine were more resistant than sheep to the intracerebral injection of pure cultures of *Listerella ovis.* Repeated intramuscular injections of large doses of saline suspensions of the organism in swine produced relatively high serum agglutination titers, but animals eventually succumbed, presenting severe changes in the central nervous system.

Graham[4], called attention to the fact that Listeria may some times be fatal to man. It was recommended that veterinarians exercise the usual precautions to prevent self infection by handling tissue of infected animals. Infected carcasses should be condemned for human food.

Abortion and Encephalitis Due to Listeria

Graham *et al.*[5] also reported that attempts to induce abortion in pregnant rabbits, guinea pigs and swine by inoculation of a strain of Listeria failed. This, of course, does not mean that under natural farm conditions abortions in swine could not occur as a result of infection.

Biester and Schwarte[6] found that Listeria encephalitis in swine was a distinct entity. In small suckling pigs, incoordination associated

Readers are referred to the following previous issues of VETERINARY MEDICINE for Parts I to VII of this series of articles by Dr. H. C. Smith: 50:565 (Nov.), 1955; 50:683 (Dec.), 1955; 51:33 (Jan.), 1956; 51:61 (Feb.), 1956; 51:102 (Mar.), 1956; 51:262 (June), 1956; and 51:311 (July), 1956.

Field diagnosis and autopsy reports have indicated increased incidence of this bacterial disease of the central nervous system of swine. Listeriosis has been considered of significant importance as a meningoencephalitis affectation of ruminants but of lesser importance in other species. It has now been established that the disease attacks other body organs and may be responsible for abortions. Furthermore, there exists the possibility that the rather widespread prevalence of listeriosis in cattle, sheep, goats, and swine might establish these domestic animals as possible reservoirs of infection for man.

Doctor Smith urges definite diagnosis in so far as possible of all nervous diseases of swine; in the case of suspected listeriosis, laboratory isolation and identification of the causative organism.

*Allied Laboratories.

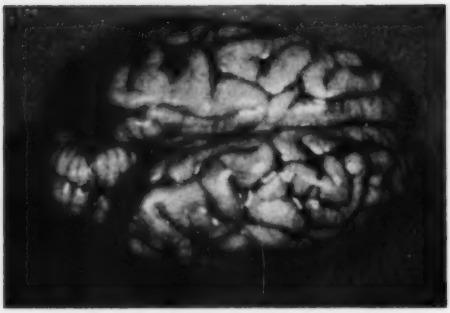

Fig. 1. Brain of pig. Diagnostic lesions of Listeria infection are indefinite in the central nervous system. Edema and meningitis are not uncommon. Isolation of the causative organism is necessary for positive identification.

with general weakness did not present the picture of a specific disease. These clinical manifestations may be present in other conditions of swine. For example: The virus of hog cholera is also capable of producing similar central nervous system disturbances.

Graham *et al.*[7], ran some studies to produce immunizing agents with both dead and living organisms. They used a formalin killed culture. Two or more subcutaneous injections of the bacterin failed to immunize sheep and rabbits. Living cultures of the organisms were well tolerated, but immunity or resistance was not obtained.

The economic seriousness of the disease is not marked at the present time, but it apparently has the potentialities of becoming serious according to Dunlap[9]. There are some serological differences in the strains isolated from the different species of animals.

Biester and Schwarte[9] recovered *L. monocytogenes* from the brains of swine. The disease manifested itself in this species by disturbances of the central nervous system. Incoordination, trembling, increased respirations, inability to stand, and jerking movements of the head and neck are common symptoms. Some pigs walk in circles.

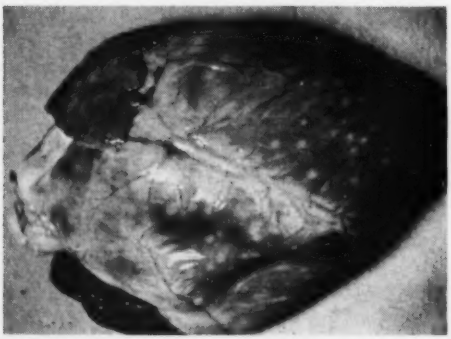

Fig. 2. Heart of pig illustrating previously undescribed lesions of listeriosis. Isolation of *L. monocytogenes* was made in this case.

An excellent piece of work was done by L. A. Julianelle[10]. Experimental evidence revealed that Listeria did not stimulate "heterophile" antibody during active infection or prolonged immunization. Antisera of high agglutinating titers offered little or no protection against infection in mice.

Graham *et al.*[11], made the observation that swine can be infected with Listeria by conjunctival exposure. Foley *et al.*[12], found that the organism was resistant to penicillin as compared to other Gram-positive cocci. The seven strains studied have been found to grow freely in 40 times the concentration of penicillin necessary to inhibit completely the growth of other representative Gram-positive organisms.

Mary Louis Robbins and A. M. Griffen[13], found that the use of minimal heat, formalin, chloramine T, merthiolate or phenol as killing agents did not alter significantly the overall capacity of *L. monocytogenes* to elicit production of antibodies.

Kaplan[14], reported on the disease in man in its typical meningeal form. It had a mortality of approximately 79%. There was little evidence to incriminate animals as direct transmittors. Widespread prevalence of listeriosis in animals established them as possible reservoirs of infection for man, characterized clinically and at necropsy as a meningoencephalitic syndrome.

Body Systems Attacked

Kerlin and Graham[15], reported the isolation of *L. monocytogenes* from the liver of a pig. The animal did not display symptoms involving the central nervous system. Postmortem examination failed to reveal significant gross pathological changes. The presence of *L. monocytogenes* raised the question of its pathological significance in nonencephalitic syndromes.

L. deBlieck and Jac Jansen[16], reported from Holland on the isolation of a bacterium from five-day-old pigs which proved to be Listeria. Multiple necrosis was found in the livers. The organism was pathogenic for pigs, rabbits, mice, rats, guinea pigs, and extremely pathogenic for canaries. The same changes in the liver were observed in the experimental animals. Encephalitis could be produced in the

pig. The strain of this organism proved to be identical with one isolated from the brain of a child who had died of encephalitis.

Kermit Peterson[17], reported that the postmortem lesions, as well as the organisms, usually were found in the central nervous system.

A report on a case of concurrent cholera and generalized listeriosis was given by Rhoades and Sutherland[18] in 1948. A farmer vaccinated his own herd of three-month-old pigs (125 head), with serum and virus. Fourteen days after vaccination the herd sickened. Eighteen died and several were sick during the ensuing two-week period. Postmortem lesions were those of generalized septicemia. The liver, spleen, and kidney, cultured on blood agar, yielded organisms having all the known characteristics of *L. monocytogenes*. A saline suspension of the organism instilled into the eye of a rabbit produced a conjunctivitis within six days.

Graham *et al.*[19] reported the death of a rabbit 23 days following ocular instillation of the organisms. The symptoms were suggestive of listeriosis. There were no significant lesions, but Listeria was isolated from the medulla.

Treatment

Ryff and Lee[20], reported on a number of therapeutic agents used on experimentally infected rabbits. Sodium sulfapyridine and penicillin gave the most promising results.

Robert Graham[21] stated that Listeria had been isolated from swine only a relatively few times. It had been found in cases of encephalitis, in septicemic conditions, and had even been reported from pox-like lesions in baby pigs. In Listeria encephalitis there were ordinarily no lesions in the viscera. In the septicemic disease the lesions may include small necrotic foci in the liver and spleen. Fluid may also be present in the pleural and abdominal cavities. Listeria may also be present along with other diseases. Isolation of the organism from the affected tissues is one of the best methods of diagnosis.

Both *in vivo* and *in vitro* tests were carried out to determine the effect of streptomycin on *L. monocytogenes* by Gray *et al.*[22]. The results of their study suggested that streptomycin was of no value in treatment. The organisms were initially inhibited but rapidly developed a fastness for the antibiotic.

Bolin and Eveleth[23] reported on the isolation of Listeria from the liver of a pig that had died from lye poisoning. This indicated that Listeria may localize in the livers of swine without

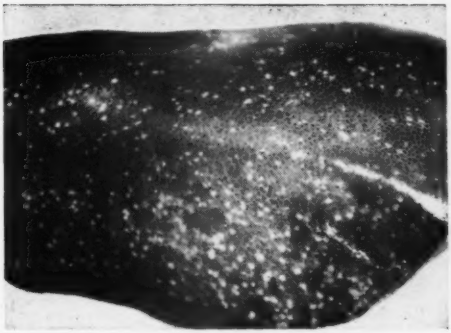

Fig. 3. Liver illustrating small abcess formation due to *L. monocytogenes*. Lesions in this case are more pronounced than observed ordinarily.

producing evidence of the disease. Many veterinarians have suspected that apparently healthy swine may be carriers and that, under certain enviromental conditions, organisms increase in pathogenicity and produce disease.

Gray *et al.*[24] reported on four years of study of listeriosis in Michigan. This was an excellent article, giving 46 references. The authors showed that this disease was primarily a disease of winter and early spring in cattle and sheep. They found that organisms can survive long periods under various conditions without loss of pathogenicity.

Hemholdt *et al.*[25] reported that a progressive type of paralysis in six-to eight-month-old affected swine. Symptoms of marked labored breathing lasting for two to three weeks was followed by complete paralysis. There was a possibility that some sows showing dyspnea and paralysis shortly after farrowing may have

Fig. 4. Small intestine of pig affected with listeriosis. Note enlarged mesenteric lymph gland and marked case of hemorrhagic enteritis. Causative organism was isolated from lymph glands and confirmed to be *L. monocytogenes*.

been infected with this organism. Veterinarians in Iowa observe quite a number of such cases during the course of a year. Paralysis of undetermined origin is observed frequently in some droves.

Two cases of Listeria were reported by Felix G. Lines and Wm. B. Cherry[26] in 1952. These involved newborn infants. One of the mothers lived on a farm and was in contact with farm animals. The serological agglutination test was positive in dilution as high as 1:200.

Eveleth *et al.*[27] believed that listeriosis was widespread and appeared to be of more importance as a cause of animal losses each year. It is not a prevalent disease of swine but it must be considered in the diagnostic procedure in all cases in which swine exhibit symptoms of central nervous system involvement. Teschen's disease may be suspected but attempts at transmission have been unsuccessful in the United States. These authors also reported[28] on an intradermal diagnostic agent which they called "listerin." Listerin was prepared by using cultures of the *L. monocytogenes* similar to Koch's method for preparing tuberculin. Small amounts injected intradermally produced tissue swelling and necrosis in sensitized rabbits. They also produced a formalin killed culture "bacterin" and have used this product in an attempt to produce immunity in sheep. This product, to our knowledge, has not been used on swine under average farm conditions in the swine producing areas. To date, the disease in swine has not been as serious as in sheep.

Eveleth[29] stated that Listeria may be associated with other diseases in swine. The first symptom is usually stiffness, followed by an arched back. Paralysis may become marked or the pig may lie on its side with running movements. Deaths usually follow in 24 to 48 hours. The disease may be confused with rabies, pasteurellosis localized in the brain, enterotoxemia (gut edema), hog cholera, erysipelas, and leptospirosis. Doctor Eveleth believed that the incidence of listeriosis appeared to be increasing.

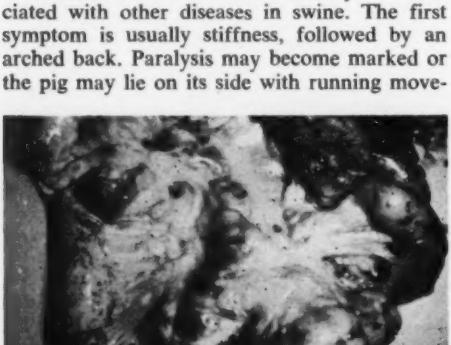

Fig. 5. Listeria infection in swine. Congestion with blotchy hemorrhages is not diagnostic. Note many small hemorrhages and the serous surface of the small intestines and hemorrhagic mesenteric lymph glands. Isolation of *L. monocytogenes* confirmed tentative diagnosis.

One of the best number of references to the literature on Listeria in all animals and man was given by Carl Olson, Jr.[30].

It was shown by Gray *et al.*[31], that abortion, stillbirth, and early death of young in rabbits could be induced by eye instillation of *L. monocytogenes*. The addition of the organism in the drinking water appeared to be a natural avenue of entrance into the body. They also proved by experiments that abortion in rabbits could be produced by oral infection. They did not imply that this was the only mode of entry for all Listeria infections. Symptoms produced included: Circling, salivation, conjunctivitis and keratitis, incoordination, dizziness, irritability, pulling the heads back over the body, falling down, excitement, coma, movements of the jaws. Clinical diagnosis may not always be justified. It could be mistaken for middle ear infecton or injury to the base of the ear.

Lesions, when they do occur, may include small necrotic foci in the liver and spleen, but these are rarely seen in all cases that come to autopsy. Veterinarians may only find acute congestion of the entire viscera which would mean little in arriving at an accurate diagnosis. The heart sac may contain a straw colored fluid similar to that found in the thoracic cavity.

Reservoirs of Infection

Until the natural reservoir of this organism can be determined, it is unlikely that its epizootiology can be established. Cultures of drinking water, straw, feed, and litter from infected premises have failed to establish the presence of Listeria. The disease has however, a tendency to recur in successive years on the same premises.

Summary

Studies of listeriosis in farm animals have been handicapped because of a lack of a reliable serological test. Usually only a few animals in a herd are affected. Abortions have been reported to occur in cattle and sheep. We need proof that abortions occur in swine herds.

The disease may be confused with hog cholera, erysipelas, leptospirosis, Aujeszky's disease, and plant or chemical poisoning.

Until more information is available regarding the transmission of this disease, suspected animals should be isolated.

Symptoms ordinarily associated with listeria encephalitis are not pathognomonic, nor are specific gross lesions always present. Diagnosis can be made only by the isolation and identification of the causative organism.

The occasional development of "red-eyed pigs" exhibiting central nervous system disturbances may be regarded as suspicious.

Attempts to produce immunity by the use of vaccines have not been entirely successful.

As knowledge of this disease increases, it is possible that Listeria may be responsible for some abortions that occur in swine herds.

Favorable results have been reported on the use of 5 gm. terramycin® added to 500 cc. of hog cholera antiserum for treatment of affected swine. Dosage of this mixture is 1 cc. per lb. of body weight injected intraperitoneally. Field results have been satisfactory.

At the present time, attempts are being made to prepare a bacterin for prophylactic treatment. Thus far the results in the field have been favorable but these need to be reevaluated.

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The most dramatic postmortem finding in infectious rhinotracheitis is a thick exudate with glue-like consistency in the trachea. This frequently occludes the trachea to the point where it causes suffocation. It may cause bronchial pneumonia. Intratracheal injection of proteolytic enzymes offers relief.—*R. E. Pierson, D.V.M.*

Field Case Report on the Use of Pregnant Mare Serum

LYLE T. BOLEY,* D.V.M., Kewanee, Illinois

Among other problems confronting the swine breeders are found those occurring during the farrowing period, such as small litters, weak pigs, or a farrowing season which is spread over a long period. This is a report of two field experiences attempting to correct an unfavorable, past breeding record. In these trials, pregnant mare serum[1] was used and records were kept to permit evaluation of results.

Pregnant mare serum is a commercial serum prepared from the blood of pregnant mares when the degree of follicle-stimulating and luteinizing hormones are at their highest peak. Gonadin® has potential use for follicle stimulation in sows and preparing the uterus for conception.

The following two episodes indicate the results obtained with pregnant mare serum under field conditions:

In the first trial reported[2], each of two boars were injected with gonadin (15 cc.—750 rat units) on March 12, 1952. On March 26, 1952, the same two boars were treated again, and at the same time 40 sows were injected with 10 cc. (500 rat units) each of the same product. The sows started coming in heat three days later. Some days the two boars would be on two sows at the same time, and about six to eight other sows would be waiting for service. After 15 days, the two boars were removed. Of 40 bred, six sows failed to conceive. At farrowing time, 34 sows farrowed. Twenty-four pigged within six days, the others within three days, producing 279 healthy pigs within a nine-day period. That is about an 8.2 average per sow. The pigs averaged about 3 lb. each at farrowing time.

The sows were put on a good balanced ration about two weeks before breeding and were kept on the same ration right through farrowing. On the day the sows were treated they received a good flush, which consisted of the same ration mixed with water and Glauber's salt. Otherwise the ration was fed in self-feeders.

The second record trial[3] took place on the Naffziger Brothers Farm in Bureau County, Ill. They were not satisfied when many of their sows and gilts did not settle or were late in settling. An increase in litter size was also desired. Since pregnant mare serum offered the greatest theoretical chance of success, it was selected for use.

The boars were first injected, intramuscularly, with 15 cc. gonadin. Two weeks later sows and gilts were injected with 10 cc., and at the same time the boars were given a second injection of 15 cc. The sows were on an excellent diet plus alfalfa and clover pasture, and during winter months were fed the same ration with 50% of it being green leafy alfalfa hay.

The following table is offered to show that the desired results were obtained:

Season & Year	No. Injected	Did Not Conceive	Pigs Farrowed	Pigs Mkt. Size
Spring 1953	54	3	517	345
Fall 1953	54	2	516	380
Spring 1954	60	1	500	392
Fall 1954	57	1	583	410
Spring 1955	62	See Note 1	485	See Note 1

Note 1: Fifty sows conceived in spring of 1955; six did not conceive; and six would have been late farrowing.

Note 2: At the time this article was written they had not been marketed.

This shows an average of 9.16 pigs per sow over the two and one-half year period, including those that did not conceive or 9.66 pigs per sow of those that did conceive. From previous average, this showed an increase of two to three pigs per litter. The owners sold an average of 6.78 pigs per sow which indicates that even with the increase in litter size the pigs were not weak runts. Since the sows came in heat and were bred within days of each other, the farrowing period was shortened which meant that the pigs were approximately the same size minimizing management problems.

In conclusion, it should be said, that the practitioners and owners in these two instances were pleased with desired results obtained. Sows and gilts had larger litters of healthier pigs, farrowed in a shorter period of time, and remained in good breeding health. Favorable results with gonadin may be expected in selected herds if management and feeding practices are adequate.

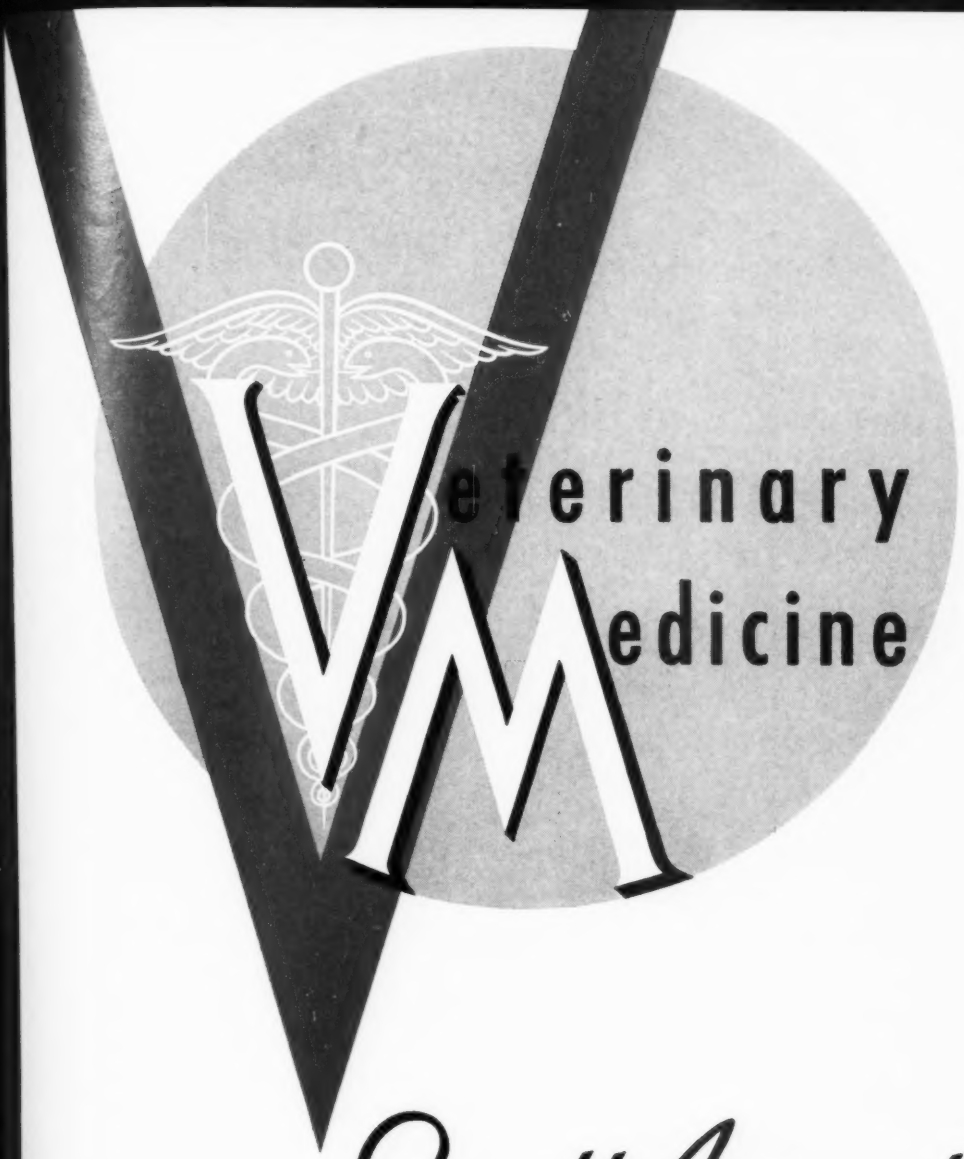
®Cutter Laboratories, Berkeley, Calif.

*Field Veterinarian, Cutter Laboratories, Berkeley, Calif.

[1]The pregnant mare serum used in these instances was gonadin® produced by Cutter Laboratories.

[2]Poppenhouse, G. C., practitioner, Milledgeville, Ill.

[3]Comba, Louis C., practitioner, Princeton, Ill.



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Development Of A Basal Ration For Hospitalized Dogs

MARK L. MORRIS,* B.S., D.V.M., Topeka, Kansas

A BASAL ration to the experimental nutritionist could be compared to the slide rule of the engineer. Such rations consist of ingredients of known chemical composition, *i.e.*, vitamin free casein, amino acids, crystalline vitamins, scientifically balanced mineral mixtures, and fats. The response in animals fed those rations can be defined; thus, a standard of measurement is available. Practical rations, such as those fed by veterinarians in animal hospitals, can be compared with a standard diet and a determination made of the degree of excellence or inferiority of the product under test.

A comparable situation prevails in a veterinary hospital. The veterinarian wishes to feed the animals under supervision in a manner which permits the clinical response to be observed. The practitioner is interested in producing results for the client and thus wishes to determine the most successful procedure. The practicing veterinarian often has requested a ration for hospital feeding comparable to the basal ration employed by the experimental nutritionist. He needs a foundation mixture of ingredients which can be employed in the preparation of rations for hospital feeding to which he can add as his clinical judgment dictates to produce the type of response desired. In addition reproducable clinical results are essential. These objectives can be accomplished provided ingredients of known composition and constant nutritional value are employed.

*Veterinary consultant in animal nutrition.

In 1951, research was inaugurated designed to attain the above objectives. A laboratory, test tube type procedure was set up under the supervision of a biochemist and food technologist to select and blend ingredients which would be practical, nutritious, palatable for the animal, biologically efficient, have a wide range of flexibility, yet be economical for practitioners to feed. Next came the engineering of a pilot plant operation which would permit cooking the blended ingredients at low temperatures and removing moisture without subjecting to high temperatures known to destroy certain nutrients. The biological testing of the product produced in the pilot plant employing dogs under carefully controlled conditions was inaugurated. These tests involved digestibility trials, metabolism studies and nitrogen balance to determine the efficiency of protein in the food. These tests provided data on the distribution of amino acids, the availablity of starches, sugars, fats, and how these are utilized. The condition of the dog's bowel and the character of the stools were observed. These researches were to evaluate the validity of the idea that a foundation food for use in a veter-

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inary hospital should contain blended properly processed whole grain cereals to which supplements such as meat, fat, vitamins and water could be added as desired. The nutritional value of the protein in a mixture of cereal grains and other ingredients is directly related to the distribution of amino acids thus this point is of fundamental interest.

Adequate Protein Value of a Foundation Diet

Assuming thorough digestibility, the nutritional value of a protein depends on a factor known as biological value, which in turn is dependent on the distribution of amino acids. The body of a dog continually draws on the food amino acids for replacing or adding to its own body proteins. Those amino acids which can not be used for this purpose are rapidly metabolized for energy sources rather than protein. This is a point which veterinarians frequently fail to fully appreciate as they feed large quantities of animal protein to dogs, such protein being metabolized for energy. The ideal situation exists when carbohydrate and fat energy are adequate and the body is working over a minimum of food amino acids in order to obtain those needed for body protein.

The amino acids for the body needs of each animal are different and characteristic. Those for the dog are illustrated in the right-hand column of table 1.

We will assume, for simplicity, that we are dealing with an adult dog weighing 22 lb. and fed strictly on a maintenance basis. The last line in the table indicates the amino acids which this dog must obtain in its food and the amounts of each needed daily.

It will now be interesting to note to what extent various proteins fed are capable of supplying these essential amino acids. The National Research Council recommends that the dog described should receive at least 40 gm. (1.41 oz.) of protein per day. Assuming that this protein is furnished by certain foods such as gelatin and various cereals, how much of the needed amino acids will the dog receive in the 40 gm. of protein consumed?

Animal gelatin, the protein cooked from connective tissue, is an inferior source of the essential amino acids. If the dog is fed 40 gm. of gelatin to fill the daily protein requirement, it will receive enough of only three of the known ten amino acids listed. As far as efficiency is concerned, it can be seen that the amount of gelatin fed would have to be increased substantially. The large amounts of non-essential amino acids thus ingested would need to be broken down for energy by the liver and the nitrogen fraction excreted by the kidney, thus placing considerable stress on the liver and kidneys, and representing a high metabolic cost to the animal.

The first cereal shown in table 1 is whole-wheat. It can be seen that a considerable improvement in the amino acids provided has been made if we compare whole-wheat with gelatin. It should be noted, however, that the figures are for the whole cereal and not for any one fraction as would be produced by milling. Thus, the combined contribution in

TABLE 1. Daily Consumption of Amino Acids by a 22-lb. Maintenance Dog Eating 40 gm. of Protein Per Day†

Protein Source	Animal Gelatin (gm.)	Whole-Wheat (gm.)	2 Parts Whole-Wheat, 1 Part Soybean Meal (gm.)	Foundation Diet: Wheat Barley, Corn, Dried Skim Milk, Yeast (gm.)	Amino Acid Requirements of the Dog†† (gm.)
dl Threonine	0.6	1.32	1.41	1.54	0.7
dl Valine	1.0	1.44	1.51	1.88	1.5
l Leucine	1.48	2.32	2.43	3.25	1.5
dl Isoleucine	0.68	1.32	1.51	1.84	1.4
dl Lysine	2.0	1.08	1.49	1.91	0.5
l Tryptophane	0.0	0.48	0.53	0.53	0.4
l Arginine	3.72	1.12	1.52	1.72	0.5
dl Methionine	0.32	0.80	0.80	0.93	0.6
l Histidine	0.4	0.60	0.71	1.33	0.5
dl Phenylalanine	1.0	2.28	2.28	2.21	1.0

†The amino acid analyses were obtained from Bolling, R. J., and Block, D., The Amino Acid Composition of Proteins and Foods. New York, 1945.

††As described by the National Research Council in their publication no. 300 entitled, Nutrient Requirements for Dogs, Washington, D. C., 1953.

amino acids from the proteins of germ, bran, and endosperm, is obtained. The figures would have been different had wheat flour been used and even less desirable with milled corn. Values with corn flakes would be even lower for in toasted cereal flakes there is destruction of some of the amino acids due to the severe heat of processing. Toasted cereal flakes rank near the bottom of the scale as far as biological value is concerned.

Unprocessed wheat is a relatively good protein source for dogs and if the dog were to eat 40 gm. of whole-wheat daily, it would fulfill its requirement for eight to ten essential amino acids. Eating this much wheat, however, would be difficult from a practical standpoint, since wheat would have to become virtually the sole item of diet. Because of dilution with other dietary nutrients, it is obvious that any protein used as a basic source of amino acids must contain them in quantities well above the minimum requirement.

Soybeans alone when properly cooked are a source of good quality protein quite similar to that from whole-wheat. Certain amino acids, however, are low in soya protein and, in several instances, it is a poor amino acid source where whole-wheat is a good one. The opposite also holds true since soya contains some amino acids in which wheat is poor. To balance up these deficiences therefore, the two cereals can be combined and, as illustrated in the third column of table 1, the protein mixture resulting has a high biological value. Forty grams per day of the protein mixture provides all of the essential amino acids for the dog. The mixture, however, barely fills the requirement for valine, isoleucine, methionine, and histidine, which again means that the dog, to fulfill his amino acid requirements from this source, would have to live on an almost exclusive diet of wheat and soybean meal.

A plentiful source of all of the essential amino acids is needed if a foundation diet is to meet the amino acid requirements when ingredients such as fat or starchy materials are added. Such a source can be obtained by adding to the already good mixture of wheat and soybean other cereals relatively rich in the amino acid which these first cereals do not provide in large quantities. Even in an optimum mixture consisting only of cereals, however, certain weaknesses in the array of amino acids exist and these can be adequately covered by adding such foods as milk and yeast, the proteins of which differ highly in their amino acid makeup from those of cereals.

The amino acids in 40 gm. of protein from a mixture of cereals with milk and yeast is shown in the fourth column of table 1. In this mixture, the amounts of each cereal and the amounts of milk and yeast were adjusted so that the maximum quantity of each amino acid needed by the dog would be provided. It can be seen that the margin of safety above the bare minimum requirement for each amino acid is wide and thus the foundation base could receive considerable dilution with other food items and still provide nutritionally adequate protein.

These data indicate the necessity of selecting the right ingredients and the proper proteins for a foundation diet. A haphazard selection can easily result in a protein of little biologic value and of low efficiency when fed to sick or hospitalized dogs.

The practicing veterinarian has observed that good quality protein in a diet is in itself not the answer to many feeding problems, but that the level and character of fat greatly influences the clinical response in the patient.

The Nutritional Value of Fats

Fat is a valuable supplement to a diet consisting mainly of cereals and is added chiefly as a source of energy. The energy content is adjusted to the desired level by adding the proper amount of fat. The quantity should be limited in the case of rapidly growing puppies but can be somewhat higher when fed to dogs for maintenance.

Fat contains twice as many calories per unit of weight as does carbohydrate, but there are other characteristics which make it a more suitable energy supplement for a cereal diet. It has, first of all, a better palatability in that it tends to lubricate the food, largely eliminating any possibly sticky or excessively solid effect due to the cereals. The "mouth feel" for the dog of a diet containing cereal and fat is improved over that of one containing cereal alone.

Fat contains no crude fiber and therefore decreases the somewhat bulky effect of a base made up entirely of cereals. This, of course, is especially true inasmuch as the fat calories exert a sparing effect of the amount of base which must be consumed. Carbohydrate energy supplement in the form of cereal would bring additional fiber with it and in the form of starch or flour would make the diet extremely sticky.

Fat decreases the rate at which a food is discharged from the stomach into the intestine and once in the intestine is less rapidly absorbed than carbohydrate. For this reason, a diet made up with fat satisfies the appetite of

dogs for a longer period than one containing all of the energy in the form of protein and carbohydrate. In feeding practice, this is of special value where the dog receives only one meal a day.

The level for adding a fat supplement must be carefully regulated and will depend chiefly on the type of complete diet being made up from the foundation food. A dog in any state of life will tend, over short periods of time at least, to adjust itself to a fairly constant caloric level. Thus, the more calories that are fed in the form of fat the less of the foundation diet will be consumed. With growing puppies the need for protein and minerals, as furnished by the foundation diet, is high and thus the amount of fat added should be limited. Probably about 15% would be a safe maximum during the time of most rapid growth. For maintenance dogs, and particularly for active ones such as working dogs during hunting, the figure could be higher.

As a wide range of fats can be used as additives, the selection will depend upon the cost and availability and upon the ease with which the fat can be handled in the hospital kitchen. The fat in any case should be fresh and free from rancid material as this is usually unpalatable to dogs and may be actually toxic. Rancid fats are also rapidly destructive to vitamin A. A solid fat after first melting or softening mixes better with a cereal base than does one which is liquid at room temperature. The latter tends to run out of the base food and coat the bottom of the feeding pan.

Recent literature data indicate that there is no essential difference in digestibility among fats which melt at temperatures below the body temperature of the dog. The more tallowy fats melting above about 100 F., however, are somewhat less digestible.

Many fats are consumed for the fatty substances which accompany them; flavors, sterols, fat soluble vitamins, and so forth. The purified fat, however, is unspecialized material from a nutritional standpoint. It is either metabolized for energy, laid down as body fat, or excreted by way of the intestine. Fats of both animal and vegetable origin appear identical in this respect and show no difference in nutritional value. This is a point frequently raised by veterinarians and one not commonly understood as many believe that dogs must be fed only fats of animal origin.

Only one group of specific nutritional factors has been demonstrated in purified fats and these are referred to as the "essential fatty acids." In 1930, Burr and Burr[1] showed that rats on fat-free diets regularly developed kidney lesions, scaliness of the feet and dandruff of the back fur. The authors fed various fats and fatty acids in an effort to learn which ones would clear up this syndrome of "low fat disease." They found that saturated fatty acids, in other words those lacking the ethylenic linkage (—C=C—) such as stearic and palmitic, were ineffective. Fatty acids such as oleic with a single ethylenic linkage were also ineffective, but those which contained two or more such linkages cleared up the disease even when fed in small quantities. Their effect was equally beneficial whether they were fed in combined form in a fat or as free fatty acids.

Later workers have been able to reproduce the above early findings on chickens, rats, and dogs[2,3,4]. They have shown that the amounts of the doubly unsaturated fatty acids needed are minute but apparently have never demonstrated the requirement in accurate quantitative terms. A good example, however, of how little fat is required was given in the original Burr and Burr paper. These authors were able to produce a curative effect in rats with as little as 5 drops of fat per day. Assuming that this fat weighed 0.1 gm. and that the rats were eating 20 gm. per day of dry food, the fat level in the diets would have been 0.5%.

The fats which Burr and Burr fed were corn oil, cottonseed oil, olive oil, and lard. It will now be interesting to note how much linoleic acid, one of the more common ones containing two unsaturated linkages, there was present in these fats. This data are presented in table 2, where two beef fats and two horse fats are added for comparison. It appears that nearly all of the common fats, fed at the usual levels, are ample sources of the essential fatty acids. The only exceptions are the tallowy, high melting point fats in which nearly all of the fatty acids are saturated. As in the case of rendered beef tallow, this situation is usually the result

TABLE 2. Essential Fatty Acids in Several Fats

Fat	Linoleic Acid (%)
Corn oil	40.9
Cottonseed oil	51.5
Olive oil	6.9
Lard	6.7
Rendered beef tallow	0.0
Beef bone fat	2.5
Horse body fat	7.0
Horse abdominal fat	13.0

Data obtained from Hilditch, T.P., The Chemical Constitution of Natural Fats. New York, 1944.

of a combination of reduction of the ethylenic linkages and a separation of the higher melting from the lower melting fats.

The above discussion has endeavored to show the importance of fat in the diet and as a supplement to a basal ration or foundation food consisting mainly of cereals. It was pointed out that most fats whether of animal or vegetable origin are entirely comparable in their value for feeding purposes.

All assembled scientific evidence including the preliminary tests with dogs indicated that a properly formulated and processed foundation food was palatable and nutritious. This ration provided the flexibility that was desired in that amount of muscle flesh desired could be added, the fat level could be adjusted, vitamin A could be increased or decreased efficiently, flesh nutrients could be completely removed, and others substituted from products such as cottage cheese or eggs, if desired. Such a foundation food could provide most of the water soluble B vitamins since they could be obtained from the natural sources or as added crystalline vitamins remaining in the product in reasonably stable form.

Vitamin A is a unstable substance and it was decided best for the veterinary practitioner to add the specific amount of this vitamin for the particular animal to be fed and as frequently as necessary, thus overcoming the industrial hazards of vitamin A instability. The practicing veterinarian would find it impractical to cook and cool the ration to be fed, thus, it seemed essential that an industrial process be devised which would allow for cooking the cereal grains with moist heat, remove the added moisture and not subject the product to high temperatures. This was accomplished. The product resulting is one to which the veterinarian can add warm water and such supplements as he deems necessary for the feeding of an individual patient. The blend of ingredients manufactured by this newly devised technic produced a granular food about the consistency of the breakfast cereal, grapenuts®. It was learned that when moisture was added at the proper levels to this product, it could be allowed to stand for many hours and not become sticky or pasty. This is an important feature in obtaining palatability of a dry foundation food which is to be used in a veterinary hospital for the feeding of sick or hospitalized dogs.

The next step was to determine, employing feeding trials with dogs, whether the product manufactured under industrial conditions was essentially comparable to that made under highly scientific controlled conditions in a pilot plant. The results of these feeding trials were encouraging as the two products were essentially comparable.

Digestibility data obtained with standardized dogs in metabolism cages is important and provides much useful information. The practical feeding under veterinary supervision of a considerable number of dogs housed on a ranch during the winter without heat and with the additional stress of reproduction appeared to constitute a valid procedure for evaluating the nutritional quality of the foundation diet.

The details of these tests can be provided subsequently. Several menus were tested. In each instance, the foundation food was supplemented with fat, vitamin A, and moisture was added. Various protein carrying ingredients were used, for example, hog liver, horsemeat, cottage cheese, and whole egg. Although each supplemented diet was tested individually, the veterinarian if he wishes can add liver, flesh, and milk protein. It should be pointed out that such a foundation food is not designed as a complete ration for a dog. It is to provide the veterinarian with a flexible, biologically tested, clinically standardized, foundation food which he can use in practice employing professional skill and judgment for determining which animals are to receive it, the amounts to be fed, and the most effective means of supplementation.

An increasing demand exists from the practitioner for a standardized basal ration to which supplements can be added so that certain clinical adjustments can be made in the feeding of hospitalized patients. Twenty-five years of fundamental research have provided more effective methods of evaluation of proteins, fats, and other nutrients. This information has made it possible to scientifically design a foundation diet®[1]. It is produced by employing specialized manufacturing technics.

®[1]Foundation Diet (F/D) — Manufactured and distributed as a Prescription Diet by the Hill Packing Company, Topeka, Kansas.

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Dog Restriction And Management In Rabies Control†

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IT is recognized by public health authorities that dog control, together with vaccination, is required in any program designed to control canine rabies[1, 2, 3]. In many of these programs, little emphasis is given the importance of the administrative aspects of dog control. Consequently, one finds a number of different agencies operating the dog shelter and the dog control services in a community. Agencies engaged include the police, private nonofficial agencies, taxing agencies, and the communicable disease section of the health department. The lack of emphasis on this phase of rabies control by public health authorities has probably been one factor contributing to the continuing problems presented by this disease.

Rabies is a problem in preventive medicine. It is logical to approach it in its entirety as a preventable, communicable disease. Dogs are the most common source of human rabies[2, 4, 5]. Prevention in dogs by restraint of the dog population and the elimination of strays, as well as the antirabies vaccination programs, is a proper function of the health department. A knowledge of the factors in disease transmission, epidemiology, and the methods of disease control is fundamental to the proper and efficient operation of a dog control program. No other than the health department has experience in dealing with disease transmission problems. This experience, understanding, and knowledge can best be utilized in rabies control by administering all phases of the rabies program. From its knowledge of sanitation problems the heatlh department can best operate a dog shelter or pound with proper regard to this aspect as well as the communicable disease angle. Health department administration of the dog control program is a more efficient and logical arrangement than the delegation of portions of the program to other governmental agencies or nonofficial agencies outside the governmental structure.

Smillie states: "Communicable disease control is one function that the health department should not delegate to any unofficial body[3].

The best possible coordination of the activities of the health department clinics and physicians giving the Pasteur treatment, and the dog control personnel is obtained by administering both programs in the same agency. With the known dangers of unneeded Pasteur treatments, this is an important public health function[3].

The areas of the community in which rabies control officers, or dog wardens, can best serve to prevent new cases of animal rabies by investigating contacts with known rabid dogs, can be determined by epidemiologic studies of the health department. These investigations and patrols will be carried out most diligently by persons trained in communicable disease control.

In organizing a dog control program in the health department, naturally the first step is passing the necessary legislative instrument. Some essentials of the ordinance are:

1. Personnel protected by civil service.
2. Dog shelter, or pound; and dog warden, or rabies control officers to be under the supervision of the health officer.
3. Compulsory rabies vaccination — a requirement for dog ownership.
4. Provisions for the implementation of the ordinance with necessary regulations.
5. A veterinarian trained in public health in direct charge of the program.

In selecting personnel for the dog program, it is necessary to remember that rabies control officers must be capable of meeting the public under difficult circumstances as well as being capable of handling dogs. Persons inexperienced in handling dogs, but adaptable in meeting people and possessing a desire to learn, can often be trained to perform these duties in a well organized program.

A program of in-service training should be organized to teach the principles of rabies control, law enforcement, court procedure, proper

†Presented at the Southern Branch, American Public Health Association, Tulsa, Okla., April 5, 1956.

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technics of handling dogs and sanitation. Movies may be used in the training program.

Uniforms should be provided for the personnel, if at all possible.

A thorough record system is fundamental in a successful program. This must incorporate a method of dog accounting as well as cash records. A procedure for auditing, at intervals, is a necessary check on the record keeping. An experienced auditor should be assigned to set up a system and devise the necessary records.

Forms should be provided for the receiving and investigation of complaints on stray and straying dog problems. These should be filed after completing the servicing of the complaint. These may be useful for future reference.

A summary giving a brief description of each dog received, by days, is an important part of the record system. Provide for a signed statement from the owner or harborer of the dog, clearing the dogs surrendered for destruction or adoption, of any recent biting incident. The importance of this precaution may well be understood by this group. Agencies other than health agencies, operating dog shelters are often unconcerned with this vital need. The writer is acquainted with many instances of the necessity for Pasteur treatments required by the premature destruction of the biting dog by a non-health agency operation of a dog shelter. This in itself is an example of the importance of operating the dog control program as a unit of the communicable disease program.

A system of tracing dogs wearing identification tags, and the notification of the owner of the dog's location, is a valuable public relations service. Proper forms are necessary for the recording of the location and condition of all biting dogs during the period of quarantine. This information, together with the proper investigation of all impounded dogs due to be destroyed, is most important to the physician treating the victim of a dog bite.

Good records with proper auditing, and adequate forms will be an important factor in a successful dog control program.

Factors that must be considered in designing the equipment used in dog control work include: (1) Cleanability, (2) protection to personnel, and (3) proper care to the dog.

Ventilation is important in the design of the dog collection vehicles, yet this must be provided without leaving large openings that are a temptation for children to reach through the vents to pet a dog. Proper drainage of the vehicle bed is important in cleaning. Metal construction is the most suitable material for the compartments of the truck.

Secure, individual compartments for rabies suspects are necessary both in the truck and at the pound. A separate section of the shelter should be reserved for the cages of the rabies suspects. Special precautions are necessary to keep visitors from this area.

Equipment for the sanitary operation of the pound should include various types of brushes, suitable facilities for the application of a hot detergent as well as a sanitizing agent, such as a chlorine solution; and, a properly designed sewer system. Water taps, hot and cold, should be installed at convenient locations to insure efficient cleaning.

Radio equipment for rapid emergency communication of the pound and the patrolling rabies control officers is an important consideration. Often the police radio facilities can be utilized for this purpose.

Many pounds are lacking in proper facilities for the veterinarians' examinations, vaccinations, and autopsies. These should be considered.

The examination room should be equipped with tables for vaccinations, examinations and and autopsies; refrigeration for vaccine; and hot and cold running water.

Adequate refrigeration will also be required for dog carcasses. This is necessary for the for the keeping of rabies suspects pending laboratory examination and for acceptable and sanitary operation.

A routine of daily cleaning and sanitizing of the pound must be developed and followed as regularly as the recording system is carried on in the office. The trucks must not be neglected in this cleaning routine. A thorough and regular cleaning schedule will keep the pound and vehicles free from obnoxious odors. A dog shelter need not be a smelly aesthetically objectionable institution; if it is, it is carelessly operated and a likely target for criticism. Clean and well painted equipment is a mark of good sanitary operation and management.

Patrolling schedules of the streets should be based upon epidemiologic principles. Areas that have yielded recent rabid animals should get special, intensive patrolling. Every effort should be made to identify and locate animals and human beings that have been bitten by the rabid dogs. Preferably, exposed animals should be destroyed immediately. An alternate procedure is a six months' quarantine for the exposed dog. This is an effective method in keeping the damage of an infected dog to a minimum.

Areas with low prcentages of vaccinated

dogs should be given particular attention. Sections of the community having less than 80% of the dog population protected by current vaccinations are the likely sources of serious outbreaks of the disease.

Emergency night and week-end service need be arranged.

Educational activities should be considered an important part of the dog control program. A most important element in this public education is a well managed pound, kept clean and odor-free, with a complete system of accurate records. Visitors should be welcomed. Encourage the public to visit the pound. Employees should explain the operational procedure to visitors. This is an excellent opportunity to explain the function of the dog control program in protecting the community against rabies. In addition, these visitors will serve to give personnel pride in their work. The opportunity of hearing such expressions as: "I didn't know a dog could be so clean" will produce a degree of enthusiasm in the employees that will be helpful in the success of the program.

The schools should be included in the educational program. Children are naturally interested in dogs and they are eager for information. Pictures of the various breeds, information on feeding and training can serve to introduce the child to the responsibilities of dog ownership in a modern community. The dog shelter may be included in the field trips that are planned for the childern in many schools.

Summary

Dog control is an important part of rabies prevention. It is one phase of a communicable disease problem. Dog control and pound activities, together with the vaccination program should be administered by the health department as a part of its communicable disease program. The program should be under the supervision of a veterinarian trained in public health procedures. Public education should be an important part of the dog program. A properly operated dog program can be an appreciated community service as well as a means of protecting the community against rabies.

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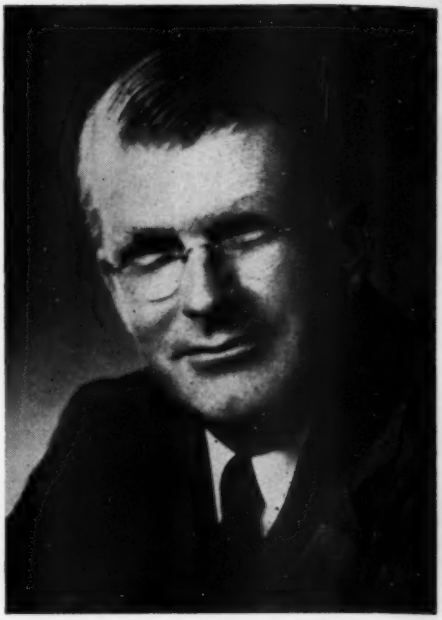

Dr. Joseph A. D. Millar, VP '28, practitioner, Deal, New Jersey was elected president-elect of the A.A.H.A. at the annual convention of that group convened in Miami Beach, Florida recently. Doctor Millar will succeed President James H. Yarborough, Miami, present incumbent at the 1957 meeting to be held in San Francisco, California.

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Listeriosis in a Dog Kennel

An outbreak of listeriosis is reported by Garlick, *et al.**, in a kennel of Weimaraners all of which had been vaccinated for distemper, infectious hepatitis, and rabies.

Initial symptoms observed involved lungs and central nervous system. Pneumonia was diagnosed in several patients and convulsions (chewing type) were observed in most of the others. Diagnosis was confirmed by isolation of *Listeria monocytogenes* from spinal fluid and from culture of vital organs of those coming to autopsy.

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Large-scale irradiation of foods for storage without refrigeration will become practicable by 1962. *Medical News.*

*Garlick, E. C., *et al.*, Listerellosis: Case Report. *N. Carolina Vet.*, 2nd ed. June, 1956.

How To Prevent Malpractice Suits†

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PREVENTION of malpractice suits is of vital importance to all practitioners. The gravity of the subject exists not because of academic significance, but because it may answer some bothersome everyday questions. Those questions, tersely stated, are: (1) What can be done to prevent malpractice suits?, and (2) What are the veterinarian's legal responsibilities?

Veterinarian's Warrants

The first step in preventing malpractice suits is an understanding of the veterinarian's legal responsibilities; his liabilities. These are those things he is obliged, is bound by law, to deliver to his clients because of his professional role. These responsibilities weigh heavily on his head the moment he professes to practice veterinary medicine. The veterinarian "automatically" warrants his clientele:

1. That he is a legally qualified practitioner.
2. That he has ordinary training and experience.
3. That he will exercise ordinary skill and diligence.
4. That he will use ordinary practice methods.
5. That he will continue his care of a case.

Before considering the implications of these warrants, it is well to clarify several things: (1) The continual appearance of the word "ordinary", and (2) the purposes these warrants serve.

Ordinary. The law is sympathetic and lenient in its demands on veterinarians, but methods and practices must at least be ordinary—they must be reasonable. This demand has grown out of man's experience over a great many years. The law expects nothing extraordinary or unreasonable, only the ordinary, the *reasonable.*

In a malpractice case, the reasonableness of the veterinarian's action is examined in the light of; (1) established modes of veterinary practice, (2) time and place, (3) differences in systems of veterinary medicine, and (4) existing state of veterinary knowledge.

For example, to treat an open joint in a dog with irrigations of Lugol's solution would certainly not be a reasonable therapeutic measure in the light of; (1) current modes of practice, or of the (2) existing state of veterinary knowledge. Neither would use of harsh cathartics or use of intravenous formalin in distemper cases be reasonable. They are out of setting in time and place. To deliver less than what is reasonable may result in a malpractice suit.

Practice is like driving a car. The most careful and skilled driver may have an accident, but his actions are not tested in court by what he thought was correct or proper but by what others think should have been correct or proper. By the same token, every event in the veterinarian's life is judged by others. It is easily appreciated that if a usually competent driver can make an error in what is largely a mechanical skill, how can the veterinarian always be free from error in such a vast field of knowledge as as veterinary medicine?

For the veterinarian to be liable for damage, it is not necessary for him to be actually wrong. It suffices that the plaintiff demonstrates beyond reasonable doubt, through expert witnesses, that his methods are not ordinary and that the fact-finder finds the veterinarian wrong.

Purpose of Warrants. What purposes do these warrants serve? The five warrants, the legal standard of practice, protect the (1) client, and (2) the animal from renegade practices of a charlatan, and (3) the veterinarian from unjust or misguided clients, *i.e.*, the client who submits a dog with a two-week-old femoral fracture and then sues because there was disfigurement, or whose elderly dog succumbed under general anesthesia during the course of a long overdue hysterectomy. The warrants also protect the veterinarian from the encroacher with his infraordinary training, skill, and methods.

To return to the five basic warrants:

1. *Legally Qualified.* The veterinarian warrants that he is legally qualified to practice veterinary medicine and surgery. This means

†Presented at the monthly meeting of the Metropolitan New Jersey Veterinary Medical Association, Newark, March 21, 1956.

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that he graduated from an accredited veterinary school, passed the state board examination, obtained his license, and has registered that license. An individual is practicing veterinary medicine, whether he knows it or not, if he; (1) professes to be a veterinarian, (2) performs surgery on animals, (3) prescribes medicine, or (4) collects a fee. Certain operations, such as dehorning, docking, and castrating, are exempt, with state variation; but even then, a fee must not be charged if these services are performed for others.

The practice right is a privilege; and as the veterinarian's privilege, it is subject to the doctrine that every person may enjoy use of his privileges just so long as they do not abuse another person trying to enjoy his privileges. Because everyone must show ordinary concern for his fellow man, a standard of what is "ordinary," as currently practiced or known, has been set up and must be met by the practitioner. To do otherwise may result in malpractice, loss of money, and revocation of the privilege to practice.

2. *Training and Experience.* The veterinarian warrants his clientele that he possesses training and experience to a certain degree. To what degree? To that degree that veterinarians are ordinarily trained and experienced. He does not warrant that he possesses extraordinary training and experience unless he has; and if he publicizes this, he immediately has a greater degree of responsibility.

The veterinarian is not responsible for, or expected to anticipate new medical discoveries. For example; if a client ran into a veterinarian's office with a current copy of a popular magazine, complaining that the veterinarian could have saved his animal if only this new wonder drug had been used, no liability would result. The veterinarian can not foresee veterinary progress. Use of this particular drug, if not currently used and accepted in veterinary practice, could be classed as an experiment, and then liability might have been proved.

The veterinarian is not bound at his own peril to choose between two schools of veterinary thought. His only concern is that his treatment is recognized at the time it was rendered. Suppose a veterinarian chose to treat an infectious disease with sulfonamides rather than antibiotics, the animal died and the veterinarian was sued, the plaintiff claiming that antibiotics had not been used and if they had, the animal would have recovered. The fact that the accepted "sulfa-school" was chosen over the equally accepted "antibiotic-school" does not make him liable. There is no control of his private professional belief.

3. *Skill and Diligence.* Possessing this requisite training and experience, the veterinarian warrants his clientele that he will use it skillfully and diligently. What degree of skillfulness and diligence? That degree ordinarily possessed by veterinarians. He does not warrant that he will use extraordinary skill or diligence unless he is a "specialist." If he represents himself to be a specialist in the diseases of dairy cattle or in canine ophthalmology, his degree of responsibility to the case is legally greater. The fact that the service is given without charge does not lessen the degree of responsibility.

4. *Ordinary Methods.* The veterinarian warrants his clientele that he will use ordinary methods in treating a case. This precludes him, to a degree, from experimenting on a case—that would certainly not be "ordinary." But, at the same time, the veterinarian knows that if the general practice of veterinary medicine and surgery is to continue to progress, if antiquated drugs and methods are to be left behind and better ones found, that a certain amount of experimental work must be done. This may be done if; (1) the client is informed of the proposed investigational procedure; and if (2) the procedure does not vary radically from accepted methods of practice. The educated client will often agree to have an untried and unproved technic used on his animal if the subject is approached diplomatically, if current therapies are insufficient, or if the case is already hopelessly affected. The burden is still the veterinarian's, however, because responsibility for the case can not be delegated to or assumed by the client.

5. *Continue Care.* The veterinarian warrants his clientele that he will continue his care of their animals until he and they sever the implied verbal contract which began when the case was accepted—or until the animal recovers, or dies. A case can not be willfully abandoned, once accepted, even though it is being treated without charge. Of course, ordinary skill and diligence and ordinary methods will be used while doing this.

Malpractice Suits

The only cause of malpractice suits, that is, justified suits that are perhaps successfully presented against veterinarians, is a breach of these five professional responsibilities. The immediate cause of perhaps 75% of these suits is another veterinarian making unjust, unkind, unthinking, or merely conversational com-

ments about the previous care of an animal. The Golden Rule applies here: "Do unto others as you would have others do unto you."

Malpractice is practically synonomous with negligence in all cases. It is doing or not doing—the commission or omission—of what an ordinarily prudent veterinarian would or would not have done in a similar situation. Cases of negligent or ignorant malpractice may be grounded in:

1. Drunkenness and addiction.
2. Abandonment of a case.
3. Damage to a case (leaving a foreign body in a wound, not sterilizing instruments prior to surgery, casting a horse ineptly and rupturing the diaphragm, an error in writing a prescription).
4. Irresponsibility for animals (postsurgical treatment, prophylaxis, nursing care).
5. Injudicious or nonuse of biologics or drugs (where clearly contraindicated or indicated).
6. Actions of careless or thoughtless employees (doctrine of *respondeat superior*).
7. Transmission of an infectious disease.
8. Unsanctioned surgery (trespass on private property).
9. Unsanctioned euthanasia (trespass and destruction of private property).

Veterinarian's Nonwarrants

The second step in preventing malpractice suits is an understanding of the things that are not the legal responsibilities of the veterinarian: (1) That he will respond to a call for service, (2) that he will diagnose correctly, (3) that he will cure a case, (4) that the animal will not be disfigured, and (5) that he is responsible for the poor nursing care of an owner.

1. *Respond to Call.* The veterinarian does not warrant that he will respond to a call for service even though he is under strong moral and ethical compunction to do so. He can not be ordered to a case at the whim, fancy, or actual emergency need of an owner. If the animal dies and it might have been saved had he attended, he is still not liable. This is based on freedom of contract. Veterinarians are not public servants, as are innkeepers or public carriers, and are under no obligation to accept all cases. There is no obligation to enter into such a contract with the owner. Freedom of contract is based more broadly on the 5th and 13th amendments to the Constitution of the United States. If he accepts the case or says he will respond, however, he has broken an implied contract or verbal contract; and liability may result. If he is under express contract to a kennel or dairy herd and refuses to answer a call for service, the basis for a breach of contract suit is even clearer.

2. *Correct Diagnosis.* The veterinarian does not warrant that he will diagnose a case correctly. If he misdiagnoses but has used ordinary skill and diligence in making his erroneous diagnosis, no liability can result. An error in judgment is not malpractice; but a court, through expert witnesses (other qualified veterinarians), decides what constitutes "allowable" error. For example, if it is virtually impossible to distinguish between canine infectious hepatitis and canine distemper in early and even later stages of the disease, a wide margin of error would be allowable. In the case of a fracture as opposed to a bruise, the margin would be slim.

3. *Cure a Case.* The veterinarian is not responsible for not curing a case. He is at best only an intermediary in the healing process. The veterinarian should never state that he will cure an animal. If he says it, he contracts to do it and if he doesn't, he is guilty of breach of contract.

It is no basis for a claim for an owner to say that if the operation had been done by so-and-so, the results would have been different.

4 *Disfigure.* The veterinarian does not warrant that an animal will not be disfigured, unless he so states. The veterinarian was not responsible for the infliction of the disease, nor for the poor outcome, if ordinary methods were used. A fracture may not repair correctly, but the veterinarian is not responsible for a bent leg if he satisfied his warrants.

5. *Poor Nursing Care.* The veterinarian does not warrant responsibility for the owner's poor nursing care of an animal under his supervision. If the owner elects not to follow instructions about keeping the dog with keratitis in a darkened room, or the fracture case indoors, and these instructions were reasonable and clearly stated, there is no liability. In fact, the owner may be found guilty of contributory negligence, in which case there is no right of action. If the instructions were a form of medical mumbo-jumbo, or not in keeping with the intelligence of the individual owner, liability might result.

Other Preventive Measures

Another preventive measure, which may sound too trite to mention, is for the veterinarian to take care of his moral and ethical ob-

ligations. If he does this, the legal obligations will be found to have taken care of themselves. There is an old Latin proverb: "He who is proficient in learning, but deficient in morals, is more deficient than he is proficient."

Still another measure is for the veterinarian to attend regularly his local, state, and national veterinary meetings. Their chief object is to prevent the production of intellectual hermits, each imprisoned in the cell of his own restricted thinking and unfit to take his place in the modern scheme of veterinary medicine. The knowledge acquired is of direct benefit. The Bible says, "The truth will make you free." Not rich, but free. In this case, "truth" will acquaint the veterinarian with what is expected of him in meeting the test of what is a "reasonable" technic.

Another measure is to keep good records. One legally important record is the hospital or field (home) case record. It should be adequate but need not be fancy. The Hospital Records Committee of the American Animal Hospital Association has proposed the following minimum record requirements:

1. Name of client, address, and telephone number.
2. Description of the patient: Breed, sex, age, physical description.
3. Date of entry.
4. Patient's accessories: Leash, carrier, et cetera.
5. Patient's name, ward, and cage number.
6. Financial record of the client, (credit rating).
7. History — (a) Immunization: Disease, method, date; (b) previous illnesses and treatments.
8. Symptoms (owner's description).
9. Physical examination: (a) Temperature, (b) pulse, (c) respiration, (d) clinician's observations, (e) clinician's recommendations: Fecal examination, urine examination, blood examination, *x*-ray, et cetera.
10. Tentative diagnosis.
11. Prognosis (severity).
12. Details of treatment.
13. Remarks, outcome and aftercare.
14. Charges and settlement.

The euthanasia record is becoming increasingly important in modern veterinary practice; some hospitals utilize surgery-release forms and autopsy-privilege forms. Each may prevent serious difficulty; and they, at least, serve as a permanent record of services rendered.

Summary and Conclusions

The first step in preventing malpractice suits is an understanding of the veterinarian's warrants; the second, to understand those things that are not his warrants. Fulfilling ethical and moral obligations, attending veterinary meetings, and keeping adequate records are other prophylactic measures.

Preventive medicine is a recognized area of modern veterinary medicine. This approach is justified not only in regard to viral, bacterial, and parasitic diseases, but in regard to malpractice suits. Each case accepted by a veterinarian is a potential lawsuit and the threat is constant; not sporadic or seasonal. "An ounce of prevention is worth a pound of cure."

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Dog World to Publish Summary of Regulation

Continuing a precedent, the July 1956 issue of *Dog World* will present a revised summary of regulations of each state pertaining to rabies inoculation and health certificate requirements for dogs entering interstate shipment.

Considering the increased traffic in all classes of dogs and the situation regarding incidence of rabies in some sections, this timely information should prove useful to both veterinarians, breeders, and dog show handlers.

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Skunk Control Program in California

A skunk extermination program has been started in Lake County, California, after five persons, including three children, were forced to receive antirabies treatment after being bitten by rabid skunks. The rabid skunks are reported to travel in packs and attack persons in broad daylight. Squirrels and foxes are also included in the control program since a number of these animals have also been found infected with rabies in the area.

Rising Incidence of Leptospirosis in Dogs

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An increasing number of samples have been received by the laboratory during the past three years for diagnosis of leptospirosis by dark-field microscopical examination and the rapid-plate aggultination test. In 1953, 50 samples of blood were submitted for dark-field examination. Of these six, or 12% were positive. The range of urea nitrogen determinations on these samples was 71-195 mg. per 100 cc. blood. The white cell count varied from 15,200 to 24,700 with a mean of 19,900. The neutrophile range was 63-71%.

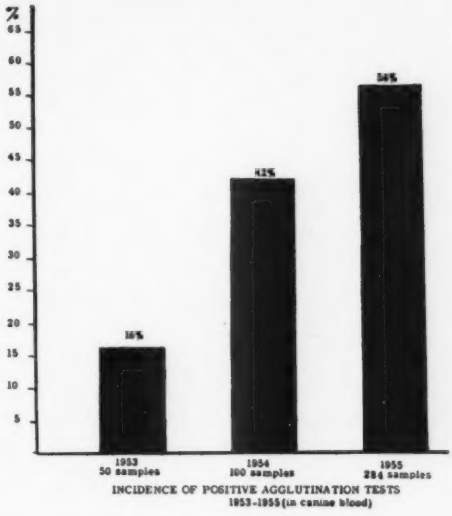
When the 50 samples were examined for agglutination, eight or 16% gave a positive reaction. The urea nitrogen on these varied from 6.1 mg. to 88.7 mg. per 100 cc. blood, with a mean value of 42.6 mg. The white cell count ranged from 12,400 to 44,450 with a mean value of 24,140. Neutrophiles varied from 55-64% with a mean of 58.4%.

The Boxer breed had the greatest number of positives and these occurred mostly in the fall of the year.

In contrast to these figures, 100 samples were examined in 1954. The agglutination test was requested on all of these and 42% proved to have a positive reaction. Urea nitrogen values ranged from 18.6 mg. to 192.7 mg. with a mean of 53.8 mg. per 100 cc. blood. White cell counts were 5,900 to 45,200 with a mean of 13,430. Neutrophiles were again normal with a mean of 62%, although the range was from 44-86%.

Boxers again had the largest number of positive reactions and these also occurred mostly in the fall of the year as they had in 1953.

In 1955, 284 blood samples were submitted for dark-field and agglutination tests. Sixteen urine samples were also submitted of which seven were positive by dark-field examination. Seventy-one blood samples, or 25% were also positive under the dark-field. The urea nitrogen values for these ranged from 9.4 mg. to 155.7 mg. with a mean value of 29.2 mg. per 100 cc. blood. The white cell counts averaged 19,177 and ranged from 6,150 to 48,550. Neutrophile



INCIDENCE OF POSITIVE AGGLUTINATION TESTS
1953-1955 (in canine blood)

percentages averaged 65% from a range of 27-86%.

Agglutination tests on the 284 blood samples produced 160 positive reactions or 56% of the total examined. The urea nitrogen values on these ranged from 8.5 mg. to 256.5 mg. per 100 cc. blood with a mean value of 34.4 mg. White cell counts were 5,600 to 81,450 with a mean of 17,587. Neutrophile percentages were 27-91 with a mean of 63% which again was normal.

The dark-field examinations indicated that most of the positives occurred in Cocker Spaniels in this year, and most of the positive agglutination reactions occurred in Poodles with Cockers ranking second.

Dark-field positives occurred more often in the fall months. Agglutination positives during May, June, and July amounted to 65, whereas in September, October and November the total was 54.

These interesting figures show the great variation in the values usually used as a yardstick to measure the possible existence of leptospirosis, and demonstrate the importance of both dark-field and agglutination tests for accurate diagnosis.

Urea nitrogen normals are generally considered to be between 10-20 mg. per 100 cc. blood in the dog. The mean values in three successive years of 42.6 mg., 53.8 mg., and 29.2 mg. show an elevation, but a variable one. Likewise the low levels of 6.1 mg. or 9.4 mg. could hardly be useful in arriving at a diagnosis of kidney damage caused by Leptospira.

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White cell counts usually fall between 6,000 and 20,000 with an average of 11,800. Averages for both 1954 and 1955 found the mean to be within this range. Low values of 5,900 and 6,150, or 5.600 could hardly be indicative of the leukocytosis generally associated with leptospirosis. Neutrophile percentages were, on the average, entirely normal for all positive samples examined throughout the three year period.

The increase in the percentage of positive blood samples from one year to another until 56% gave a positive titer, strongly suggests the mounting proportion of the canine population afflicted with this disease.

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Transmission of the Aujeszky Strain of the Pseudorabies Virus to Suckling Hamsters†

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FRANCES S. YANCEY**, M. S., and
A. L. BRUECKNER***, V.M.D.,
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The Aujeszky strain of the pseudorabies virus used for this study was originally isolated in Hungary by Aujeszky in 1902, and is recognized as identical with the pseudorabies ("mad itch") virus causing the disease in the United States. Hurst, 1934, found rabbits susceptible to this virus when inoculated by peripheral routes, and Shope, 1933, found guinea pigs and mice susceptible by peripheral routes to rabbit passage virus. Reagan *et al.*, 1952, found hamsters and mice also susceptible by peripheral routes to rabbit passaged virus.

Materials and Methods

The virus employed in this study was the Aujeszky strain furnished by the American Type Culture Collection section in Washington, D. C. This virus in infected rabbit brain had originally been obtained from A. Aujeszky in 1931. Before receipt at this laboratory, the virus had been passed several times in rabbits. The exact number of passages is unknown. The glycerinated rabbit brain was ground in a mortar with alundum and diluted to a 20% suspension with physiological saline. This 20% suspension was used as the inoculum throughout the present study.

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TABLE 1. Response of Lactating Hamsters Injected Intraperitoneally with the Aujeszky Strain of Pseudorabies Virus

Lactating Hamster No.	Virus	Amount of Injection (ml.)	Suckling Removed after Exposure (days)	Appear. of Sympt.	Mouse test
1	Pseudorabies	0.2	6	6-10 days	Pos.
2	Pseudorabies	0.2	6	6-10 days	Pos.
3	Pseudorabies	0.2	6	6-10 days	Pos.
4	Normal control	0.2	6	Negative	Neg.

Two guinea pigs were injected intradermally with 0.1 ml. of the inoculum to check the pathogenicity of the specimen. Three days after injection the guinea pigs exhibited characteristic symptoms, scratching and biting of the skin at the site of inoculation, excessive salivation, prostration, and death.

Experimental and Results

The following study was undertaken to see if the pseudorabies virus could be transmitted in the mother's milk to sucklings. Reagan *et al.*, 1955-1956, found that West Nile, rabies, Dengue, and Semliki Forest viruses could be transmitted in the mother's milk to sucklings but the three poliomyelitis types (Mahoney Type I, M.E.F. 1 Type II and Saukett Type III—Reagan 1956) could not be so transmitted. Four lactating hamsters and their sucklings were placed in individual metal boxes with bedding. The sucklings were about 12 days of age and, as they are usually weaned at 16 to 18 days, they were removed from the parent six days after inoculating the dam with virus bearing material. The lactating hamster from groups 1, 2 and 3 was given 0.2 ml. of the above described 20% suspension of pseudorabies virus intraperitoneally. The lactating hamsters from group 4 was treated likewise using 20% normal rabbit brain (control). All areas of injection were sterilized with iodine for one hour before the parent for each of the four groups was placed with her sucklings. During the six days following the inoculation of the mother, the groups were not disturbed. Dog checkers were fed to each of the four groups daily along with a large bottle of water for drinking (table 1). At the end of the sixth day, the sucklings from each group were weaned and placed in special glass jars. Three of the lactating adults developed central nerv-

ous system symptoms between six to ten days (table 1), scratching, with biting, excessive salivation, prostration, and death. The control group parent (4) appeared normal throughout the experiment. The brain of the adult hamster from group 1, 2, and 3 was removed aseptically, ground in a mortar with alundum and diluted to a 20% suspension with physiological saline and each was injected intradermally into six Swiss albino mice. The mice exhibited the same symptoms described above after a six-day observation period.

TABLE 2. Response of Suckling Hamsters after Weaning from Lactating Parent to the Aujeszky Strain of Pseudorabies Virus

Group No.	Suckling No.	Virus (Pseudorabies)	Onset of disease from days of mother's exposure to the virus	Mouse Test (dermally)
1	1		9 days	Positive
	2		9 days	"
	3		9 days	"
	4		10 days	"
	5		Negative	Negative
	6		Negative	Negative
2	1		10 days	Positive
	2		10 days	"
	3		10 days	"
	4		10 days	"
	5		10 days	"
3	1		9 days	Positive
	2		10 days	"
	3		Negative	Negative
	4		Negative	Negative
	5		Negative	Negative
	6		Negative	Negative
4	1	None (control)	Negative	Negative
	2		"	"
	3		"	"
	4		"	"
	5		"	"
	6		"	"

The three groups of weaned hamsters from the three infected lactating animals and the control hamsters were fed, watered and checked twice daily (table 2) for pseudorabies symptoms. Three to four days after weaning, suckling hamsters from group 1, 2, and 3 showed pseudorabies symptoms. Brains from all sucklings showing these symptoms were removed aseptically, pooled, ground in a mortar with alundum and diluted to a 20% suspension with physiological saline, and then injected intradermally into Swiss albino mice (table 2) in order to confirm that virus was present in the suckling hamster brain.

At the end of 14 days all suckling hamsters which had no symptoms of pseudorabies were sacrificed and their brains were removed aseptically, pooled, ground in a mortar with alundum and diluted to a 20% suspension with physiological saline. The control sucklings were done likewise. The pooled suspension from group 1, 2, 3, and from the control group (4) were injected intradermally into six three-week-old Swiss albino mice. The results are given in table 2.

Summary

From this observation, it appears that the Aujeszky strain of pseudorabies may be transmitted from lactating hamsters to its sucklings. One hundred per cent of the mothers exhibited pseudorabies symptoms from six to ten days after exposure to the virus. Sixty-nine per cent of the suckling hamsters developed pseudorabies symptoms. The control remained normal throughout the experiment.

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Membership in the Veterinary profession of today is a position of trust which any man may well be proud to assume.—*Ralph L. West, D.V.M.*

The Place for Metrazol®[1] in Feline Surgery

WALTER A. LAWRENCE, B.S., D.V.M.,
San Antonio, Texas

Cats that have been given a preoperative opiate and an intravenous barbiturate anesthetic are prone to cause trouble for the surgeon, even though they have had the benefit of the usual presurgical supportive measures and judicious induction of anesthesia. This is true of cats generally, and especially so of those that are injured, emaciated, debilitated, toxic, old, or with reduced liver function. During surgery, these animals are likely to exhibit unmistakable evidence of respiratory depression, circulatory weakness, or dangerously deep anesthesia. Some of them become problems only after the operation, when they remain anesthetized too long or fail to recover promptly. Other cats are problem patients both during and after surgery.

The common denominator of these problems of feline surgery would seem to be the susceptibility of the feline central nervous system to central depressant influences. During the operation, the primary of these influences are the effects of the opiate, the anesthetic, and a developing anoxia, as well as unavoidable surgical trauma. Also contributing to the depression state could be the lower functional level of central nervous system activity that exists in injury, debility, toxemia, or senility.

After surgery, the central nervous system, due to the same depressant factors, is incapable of functioning normally, often for as long as several days. Consequently, the cat patient continues to be handicapped by inefficient and inadequate respiration, sluggish circulation, anoxia, blunted reflexes (including the cough reflex), unconsciousness and greatly reduced voluntary muscle activity. In this could, and often does, lie the genesis of atelectasis, aspiration and hypostatic pneumonia, delayed collapse, and thrombosis.

Inasmuch as central nervous system depression is the seat of many of the complications that feline surgical patients develop, a central stimulant drug probably would be the logical means for preventing difficulties or getting out of trouble should such unexpectedly develop. This has been my experience.

Of the central stimulants, I prefer metrazol. It is potent, quick-acting and sure-acting when given intravenously, intramuscularly, or orally. Furthermore, it offers a comfortable margin of safety. And another important advantage is that metrazol gives a sequence of brain response—respiratory center, vasomotor center and, from larger doses, cerebral cortex—that best suits the clinical demands of these depressed cats. With usual doses one does not have to accept unwanted cortical excitation in order to get wanted respiratory and circulatory effects. Yet a sufficiently large dose so strongly stimulates the cerebral cortex that an anesthetized animal will awaken from anesthesia.

When I have an injured, old, toxic or debilitated poor-risk cat for elective surgery, in addition to the usual preoperative measures, I give it one-half a metrazol tablet three times daily for two or three days. Preliminary to induction of anesthesia the cat is weighed and given metrazol in a one tablet per 10 lb. body weight dose. Twenty to 30 minutes later, the preoperative opiate (dilaudid®[1] or demerol®[2]) is administered. Fifteen minutes later the animal is anesthetized with intravenous pentobarbital. Good surgical risk patients and emergency cases are handled in the same manner, except that they do not receive oral metrazol during the two or three preoperative days.

If during the operation, breathing becomes unsatisfactory or the level of anesthesia becomes too deep, I inject metrazol intravenously and to effect.

At the conclusion of the operation, the cat is given 0.5 cc. metrazol intravenously, followed in one hour by 0.5 cc. intramuscularly.

To a great extent, the same factors which physiologically depressed the central nervous system of poor-risk feline surgical cases prior to surgery continue to depress these animals during at least the first few postoperative days. Consequently, the preoperative regime previously outlined is continued postoperatively until these patients are well along the road to recovery.

I have given preoperative metrazol to many cats and have yet to see evidence of this drug having had any significant bearing on the amount of anesthetic required or its having altered the patient's response to pentothal. My records also show that since I started using this central nervous system stimulant before operations, I have not had a patient die from respiratory failure. Cats that are given metrazol injections at the end of the operaion and oral metrazol postoperatively are not "knocked out" for two or more days. Their return to normalcy is quicker, smoother and less eventful than was formerly true of my feline surgical patients.

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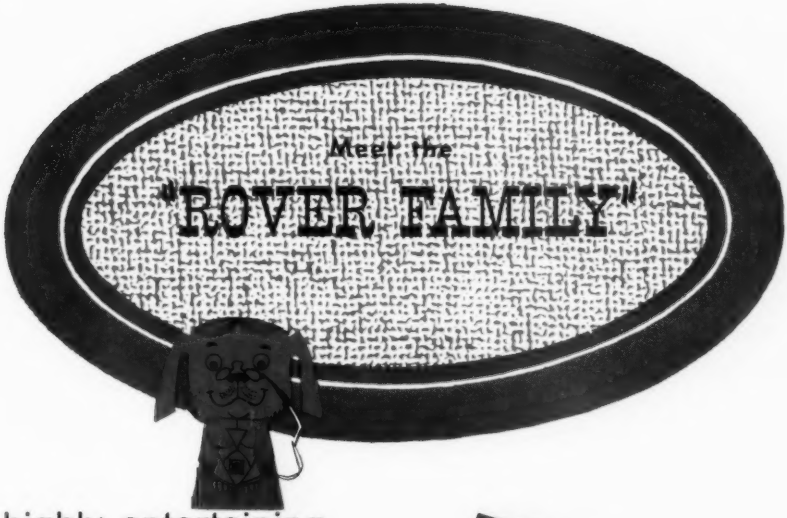

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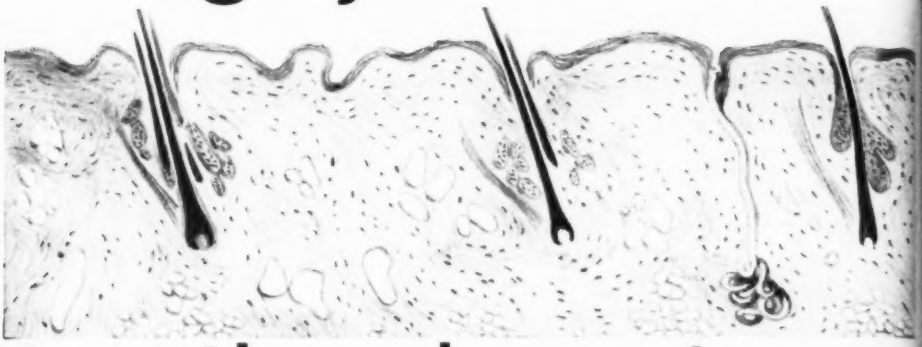

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The Apparent Surface Tension And Relative Viscosity Of Paunch Fluid Of Cattle Fed Hay, Fresh Grass, Or Fresh Legumes†

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IT IS GENERALLY accepted today that legume bloat results from interference with adequate gas elimination from the paunch rather than from an over-production of paunch gas. Regardless of whether the technics employed to measure gas production have been adequate to allow one to infer that any particular feed produces more or less gas in the paunch than any other, it is not difficult to demonstrate; (a) that it is possible to interfere with belching by raising the fluid level of the paunch[1], (b) that the effective paunch fluid or froth level of fistulated animals fed fresh legumes is sufficiently increased, despite a lesser intake of water, to cause greater spilling around the plug than when hay is fed[2], (c) that gas bubbles in the ingesta from the lower regions of the paunch are more numerous when fresh legumes are fed than when hay is fed[3], and (d) that there are observable differences in the consistency and foaming character of ingesta when different kinds of feed are given[4].

This experiment was designed to determine whether dependable measurements of apparent surface tension (ST) and relative viscosity (Vis) of paunch contents could be made and whether changes in these properties are related in any way to feeding times, to the kinds of feed fed, and to watering.

Methods

Two mature dry Jersey cows with rumen fistulas were stanchioned and placed on similar feeding, watering, and sampling schedules. Paired samples of rumen content were taken from near the top and near the bottom of the paunch of each cow in the morning before feeding or watering (sampling time 1). Similar samples were taken approximately one-half hour after feeding (sampling time 2). A third group of similar samples was taken after watering (sampling time 3). The cows were again fed and watered later in the day.

Each sample of rumen juice was immediately strained through one layer of cheesecloth to remove coarse particles, divided, and one part centrifuged at approximately 160 x gravity for 30 minutes. Duplicate measurements of apparent surface tension with a DuNuoy tensiometer and relative viscosity with a Stormer viscosimeter were made on the uncentrifuged and centrifuged portions of each sample.

Seven days' data were accumulated for each kind of feed. After changing feed six days passed before new data were obtained. The hay fed was mostly alfalfa of fairly good quality. The grass was young brome, cut and fed the same day. The legume was chiefly young prebloom alfalfa, also cut and fed the same day. Some ladino, red and sweet clover were present in the same field but the cutter bar was adjusted to cut chiefly alfalfa tops. All feeds were manger fed without limitation of quantities.

Results

In all, 2,016 measurements of apparent surface tension and a like number of relative viscosity were made, averaged (table 1) and subjected to statistical analysis.

TABLE 1. Means of 2016 Measurements of Apparent Surface Tension (ST) (dynes) and Relative Viscosity (Vis) (Water = 1.0) of Paunch Fluid of Cattle Fed Alfalfa Hay, Fresh Grass, or Fresh Alfalfa. (Water = 69.56 dynes at 40 C.)

Time	Cow No.	Alfalfa Hay		Fresh Grass		Fresh Alfalfa	
		ST	Vis	ST	Vis	ST	Vis
Before Feed	1	52.6	1.120	52.9	1.153	52.1	1.181
	2	54.1	1.223	53.0	1.216	52.7	1.299
After Feed	1	51.0	1.120	52.7	1.137	54.3	1.144
	2	52.1	1.200	53.4	1.216	56.3	1.178
After Water	1	52.8	1.053	52.4	1.099	54.2	1.085
	2	53.4	1.103	53.9	1.108	56.2	1.108

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The quantities of water taken by or introduced into each cow between sampling times 2 and 3 were recorded (table 2).

Coefficients of variability of duplicate measurements of apparent surface tension and relative viscosity of each sample and of duplicate samples indicate a good reliability of technics of measurement and methods of sampling (table 3).

A comparison of the means of all samples taken from the top of the paunch (ST = 53.2 dynes; Vis = 1.155) and all samples taken from the bottom of the paunch (ST = 53.4 dynes; Vis — 1.149) suggests good homogeneity of paunch fluid with respect to these two properties. All of the F values for position are not significant (table 4).

A comparison of the means of all strained portions of samples (ST = 52.1 dynes; Vis = 1.228) and all centrifuged portions of the same samples (ST = 54.5 dynes; Vis = 1.076) suggests that the presence of food particles, microorganisms, et cetera, resulted in decreased surface tension and increased viscosity. All F values are highly significant or significant (table 4).

Variations between times exist except for ST when the cows were fed grass (table 4).

TABLE 2. Daily Water Intake (lb.) Between Sampling Time 2 (After Feeding) and Sampling Time 3 (After Watering).

Day	Cow 1	Cow 2	Cow 1	Cow 2	Cow 1	Cow 2
	Alfalfa Hay		Fresh Grass		Fresh Alfalfa	
1	70	40	30	25	*10*	*10*
2	80	20	35	*20*	*10*	*10*
3	80	40	10	15	*10*	*10*
4	70	20	*20*	*10*	*10*	*10*
5	15	40	20	*10*	*10*	*10*
6	60	70	20	25	10	20
7	70	35	10	20	*10*	*10*
Mean	64	38	21	18	10	11

Figures indicate the amounts of water introduced into the rumen following refusal of the animal to drink voluntarily.

TABLE 3. Coefficients of Variability (%) of Measurements of Apparent Surface Tension and Relative Viscosity of Paunch Fluid for Sample Duplicates and Duplicate Samples

Feed	Cow No.	Sample Duplicates		Duplicate Samples	
		ST	Vis	ST	Vis
Alfalfa Hay	1	0.41	0.01	3.37	0.46
Alfalfa Hay	2	0.45	0.01	3.28	0.56
Fresh Grass	1	0.37	0.01	2.75	0.51
Fresh Grass	2	1.09	0.01	2.19	1.00
Fresh Alfalfa	1	0.38	0.01	2.19	0.64
Fresh Alfalfa	2	1.02	0.01	1.93	0.64
All feeds	1	0.39	0.01	2.77	0.54
All Feeds	2	0.85	0.01	2.47	0.73
All feeds	Mean	0.62	0.01	2.62	0.64

Discussion

Examination of the means (table 1) for samples taken before feeding, after feeding, and after watering, suggests the following:

1. Feeding alfalfa hay caused a reduction in surface tension (ST) and little change in viscosity (Vis) whereas water intake during the hay feeding period caused an increase in ST and decrease in Vis.

2. Feeding fresh grass caused no appreciable change in ST and little change in Vis. Water intake of grass fed animals caused no appreciable change in ST but was followed by a lowered Vis.

3. Feeding fresh alfalfa caused an increase in ST and decrease in Vis. Water intake of alfalfa fed animals caused no appreciable change in ST but was followed by a reduced Vis.

4. The Vis of the paunch samples taken before feeding during the period when fresh alfalfa was being fed was appreciably higher than that of the samples taken before feeding during the periods of grass or hay feeding.

5. ST and Vis were higher in cow 2 than in cow 1. The paunch content of cow 2 was generally drier. Cow 2 usually consumed less water per day than cow 1.

(Continued on page 392)

TABLE 4. F-Values

Variables	Cow No.	Alfalfa Hay		Fresh Grass		Fresh Alfalfa	
		Surface Tension	Viscosity	Surface Tension	Viscosity	Surface Tension	Viscosity
Position	1	0.36	0.27	0.36	0.64	0.52	0.04
	2	0.05	3.89	0.13	0.27	1.97	0.51
Centrifugation	1	82.62**	42.66**	55.86**	155.11**	8.67**	61.53**
	2	61.94**	44.17**	35.84**	92.74**	7.32*	19.17**
Times	1	5.24*	7.58**	0.22	18.69**	4.57*	8.94**
	2	4.86*	13.68**	0.99	19.11**	18.82**	5.55*

*Significant at 5% level. ** Significant at 1% level.

EDITORIAL COMMENTS

Compulsory Poultry Inspection Controversy

Public health authorities close to existing sanitary conditions in the poultry processing industry compare the situation as regards inspection of poultry for wholesomeness with that existing in the red meat industry 50 years ago. Conditions then prompted Upton Sinclair's now famous The Jungle, the subsequent Neill-Reynolds Report, and finally passage of the meat inspection amendment to the Food and Drug Act, calling for compulsory inspection at government expense.

Unfortunately, poultry was not included in the Meat Inspection Act. At that time (1906), poultry raising was either a back-yard project or an incidental operation on the farm largely under the care of the farmer's wife. Poultry production has since become big business. In 1954, 1,050,000,000 broilers were raised commercially, slaughtered largely in plants devoted exclusively to such operation, and sold as whole dressed carcasses, cut-up chicken, and in a variety of fresh, frozen, and canned forms. Today's housewife seldom if ever sees a live chicken. No such agency as that assuring the wholesomeness of red meat exists for poultry. The time is overdue for adequate compulsory poultry inspection.

It is true, that an inspection service for sanitation and wholesomeness is maintained by the Agricultural Marketing Service of the USDA. Inspection is voluntary. The processor is under no obligation to have his product inspected, and, if he does seek inspection he must pay the full cost of it. Small wonder that only 21% of dressed poultry entering interstate commerce is inspected for freedom from disease. That public health hazards exist in uninspected dressed poultry is well documented. Also figures are available indicating condemnations (1,843,446 carcasses in 1953) of which 85% were disposed as unfit for human consumption because of disease. If applied to all plants, condemnation figures would have been multiplied (x 5).

Three Congressional Bills

Proposed federal legislation on poultry inspection is contained in three bills recently introduced in Congress. Senate 3176, provides for adequate inspection of poultry products before they can be placed in interstate commerce. Regulatory supervision is placed in the Food and Drug Administration of the Department of Health, Education, and Welfare. Hearings on this bill were held May 9 and 10, 1956 at which time the Association of State Public Health Veterinarians (represented by Dr. Oscar Sussman), Association of State & Territorial Health Officers and the American Veterinary Medical Association were among 20 organizations that testified in support of the bill's provisos. Some of these felt that inspection should be placed in the Meat Inspection Branch of the USDA. Senate 3983, is essentially the same bill as Senate 3176 except that administration is placed under the Secretary of Agriculture with the direction that poultry inspection be combined with the red meat inspection service. This bill meets the recommendations of public health officials. Hearings on this bill were held on June 19.

On the other hand, Senate 3588 is misleading and would fail to provide compulsory inspection. It is based primarily on marketing considerations and thus would scarcely improve alarming inadequacies as presently administered by those primarily interested in marketing, thus responsible to industry, instead of to the consumer who has the right to expect competent inspection.

It is shocking to learn that the United States Department of Agriculture and the Institute of American Poultry Industries support that bill (S:3588) which does not provide for proper compulsory inspection but may mislead the consumer into thinking so. Are the reasons for support of this bill the same as those that resulted in the attempt by the poultry industry group to effect such changes in regulations as to affix "U. S. Grade A" labels on poultry carcasses not inspected for wholesomeness? (See VETERINARY MEDICINE, 45:331 [Aug.], 1950; 46:23 [Jan.], 1951; 47:21 [Jan.], 1952; 47:59 [Feb.], 1952).

Considering the facts established by precedence, that consumer confidence is a stimulus to sales, why indeed does the poultry industry group continue to countenance and actually to succor "salesman-graders" in positions of public health trust for which they are not qualified? There appears to be flagrant lack of integrity and responsibility to the consuming public in this action.

The Institute of American Poultry Industries (*Institute Weekly Letter* for May 2 and May 9)

calls S. 3588 "industry's bill", and suggests that members contact senators to oppose S. 3176 and support S. 3588. It appears that the interests of the poultry processors are firmly entrenched with those of the USDA marketing service.

The Association of State Public Health Veterinarians whose president is Dr. Martin P. Hines of the North Carolina State Board of Health, through Dr. Oscar Sussman, of the New Jersey State Department of Health has taken aggressive action to prevent the continued sale of improperly processed poultry in interstate commerce. Poll of members of the A.S.P.H.V. indicated that the majority believed that immediate action was necessary to prevent the continued sale of improperly inspected or noninspected poultry in interstate commerce and that inspection service should be placed in the hands of a consumer protective organization.

The interests of the consuming public, poultry husbandrymen, and processors can be served best by support of S. 3983, assuring an adequate poultry inspection service. The wisdom of acquiring the services of an organized and experienced group, which has earned the confidence of the consuming public to perform the necessary work is unquestionably sound.

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Gastrointestinal Complications of of Oral Antibiotics

Symptoms of intestinal abnormalities are not infrequent sequela of oral antibiotic therapy, according to Binn*. Frequency has been noted in some instances to approach 30% after heavy dosage of some of these products.

Majority of these alimentary complications are due to minor disturbance in balance of microflora and the irritant effect on intestinal mucosa. These are exemplified as sore tongue and mouth, nausea, occasional vomiting, bloat, diarrhea, and the familiar anal-rectal syndrome. These complications subside promptly after medication is removed as a rule, but may be responsible for rather serious set-backs, and from some recent disturbing reports, superinfection by organisms resistant to antibiotics. Emphasized, in the author's report, is the importance of considering alimentary side effects of oral antibiotic therapy particularly in an environment where experience has demonstrated prevalence of resistant pathogens.

*Binn, T. R., Gastrointestinal Complications of Oral Antibiotics. *Lancet*, 336:8 (Mar. 24), 1956.

Increase Enrollment for D.V.M.— Silent Partner Income Protection Insurance

Advice has been received from Silent Partner Associates Plan Administrator Mr. Peter N. Jans that by the official action taken by the membership, the North Carolina Veterinary Medical Association became the 23rd state veterinary association to adopt the plan underwritten by the Continental Casualty Company.

Those states that have taken such action are to be complimented for adopting the worthwhile service offered by a reliable casualty company.

Other state groups are testing desire of their membership and beginning special enrollment campaigns. If the required participation is obtained, it will be possible for every active veterinarian, up to age 70, regardless of past medical history or present physical condition to obtain the same benefits as preferred risks. Coverage for members of the veterinarian's family are also made available under the D.V.M. plan.

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X-ray of the foot is useful to determine proliferative changes in bone in advance of claw amputation. *W. F. Riley, D.V.M.*

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Paunch Fluid of Cattle

(Continued from page 390)

6. Surface tension and viscosity appeared to vary independently.

Summary

Dependable measurements of apparent surface tension and relative viscosity of paunch fluid can be made. There are differences in these properties which can be related to feeding times, to kinds of feed, and to watering. A different form of even the same plant variety (alfalfa hay *vs* fresh alfalfa) produces different physical responses during paunch digestion.

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Report from Malaria Conference

The various aspects of malaria control in South-East Asia and the Western Pacific are examined in detail in the recently published report on the Second Asian Malaria Conference, held in Baguio, Philippines, in November 1954 (World Health Organization — WHO — Tech. Rpt. Series 103, 1956).

Problems connected with some vector species of these two regions, which, in certain cases, had cast some doubt on the effectiveness of residual spraying, constituted the first item for discussion. Of special concern was the development of resistance to insecticides in anophelines, and stress was laid on the fact that, in the absence of an emergency, chlorinated-hydrocarbon insecticides should not be used either concurrently or consecutively as both imagicides and larvicides in a given area. It was also recommended that basic research be undertaken on the physiology of insect vectors and on their biological variations and susceptibility to insecticides, and that experimental work connected with the control of certain species be continued.

Tularemia in Sheep

Tularemia occurring as epizootics in sheep is reported in a monograph[28] prepared by researchers at the Rocky Mountain Laboratories, Hamilton, Mont.

Epizootics always are associated with heavy infestation of wood tick, *Dermacentor andersoni*, a recognized vector of the disease. They occur in the spring of the year in western sage brush areas and concurrent with epizootics in rodents (rabbits, prairie dogs) disease reservoirs.

The authors have record of 183 cases in persons associated with the sheep industry. Highest incidence was noted in sheep shearers. Many cases resulting from contact or tick bite were severe, and at least seven cases of the study group were fatal.

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[28]Jellison, Wm. L. and Kahls, Glen M., Tularemia in Sheep and in Sheep Industry Workers. P. H. Monograph 28, U. S. Government Printing Office. Washington, D. C., 1955.

Arneson River Theatre — In a bend of the San Antonio River in the heart of the downtown area, a theatre has been constructed. Concession and projection room stand on the south bank above tiers of grass seats were approximately 1,000 can witness performances given on the stage across the river. A dressing room building of Spanish design adjoins the stage.

Broadening Use of Closed-Circuit Television

The media of closed-circuit television made its debut initially to veterinary audiences on the occasion of the 88th annual convention of the American Veterinary Medical Association held in Milwaukee, Wis. in 1951. That portion of the program sponsored by the Allied Laboratories Inc., and the Radio Corporation of America, indicated the value of television for demonstrations of clinical, surgical, and laboratory procedures. Viewers had a close-up of the technic of the operator or surgeon while comfortably seated, a feature never before possible. The plans of annual A.V.M.A. conventions and subsequently A.A.H.A. meetings have since made use of this effective educational media. It has not only aided speakers and demonstrators to influence groups of veterinarians fortunate enough to learn from them but has been of inestimable value in attracting practitioners to conventions and holding their interest in new technical procedures. The exciting prospect of learning by seeing is reflected in the surging interest shown in telecasting at each successive veterinary convention where it is used.

During the last two or three years broadening use has been made of closed-circuit television at state group meeting, principally those held on campuses of state universities where television stations are available for training in engineering and for other educational uses. Among state groups having cooperation of college facilities and personnel is the State College of Washington. This was demonstrated at the eighth annual Conference for Veterinarians, held on April 2-4, 1956. The accompanying photograph depicts Dr. Jacques Jenny, University of Pennsylvania, Philadelphia, an outstanding figure in the field of veterinary surgery, particularly that classified as orthopedics, lecturing and demonstrating in the temporary television studio set up for that conference.

Veterinarians now get "over-the-shoulder" views of surgical technics, formerly available to only a few, via closed-circuit television. The technic rates as the most significant advance of the century in educational media, surpassing effectiveness of illustrated lectures, both those employing slides or motion pictures.

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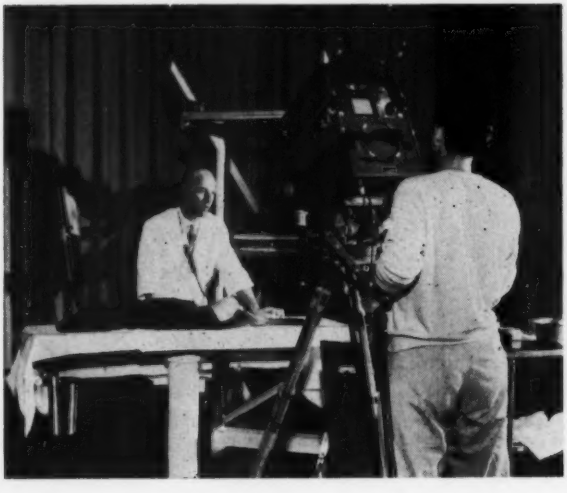
Washington is Now Modified Certified Brucellosis Free

On June 1, 1956, the State of Washington became the fourth state in the nation to be modified certified brucellosis free, and the first since the establishment of the accelerated control effort. Maine, New Hampshire, and North Carolina have been assigned disease-free status previously.

State veterinarian Dr. A. E. Crouse advised in a communication that the accomplishment was possible through cooperation of livestock owners, agencies interested in the industry, and the state's practicing veterinarians. After years of effort, Washington has reached a disease control goal four years ahead of the national target.

A concentrated eradication program was started in Washington in 1950. At that time approximately 10% of the cattle were infected. Working county by county, the final areas



Dr. Jacques Jenny, University of Pennsylvania demonstrating orthopedic surgery on the dog at the Washington Conference for Veterinarians.

were certified, giving Washington the coveted state-wide disease-free standing.

During the past six years some 1,500,000 head of cattle have been blood tested and 500,000 calves have been vaccinated. The milk ring test was used widely to locate points of infection. Indemnity costs totaling approximately $1,000,000. were shared equally by state and federal governments.

Congratulations to those who made this accomplishment possible. The state's livestock industry can also be proud of this significant and newly won distinction.

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Wisconsin also joins the list of those states declared Brucella modified certified free in June 1956, becoming the fifth state to gain the coveted goal. Wisconsin, a major livestock producing area and first in numbers of dairy cattle is also first of the midwestern states to be "brucellosis free."

It is understood that Minnesota, Montana, and Delaware may complete necessary requirements of the accelerated Brucella control program this year—75% of the nation in three or four years.

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Reduced Incidence of Human Brucellosis in Washington

Review of the incidence of human brucellosis in the state of Washington graphically illustrates the public health aspects of the elimination of bovine brucellosis.

Concurrent with the elimination of reactor cattle, epidemiologists, report less human infection *(Morb. & Mort. Wky. Rept., June 29, 1956).* Ten years ago, there was an average of 50 cases of brucellosis reported in Washington each year. The incidence rate in 1946 was 2.6 per 100,000 population. In 1952, the rate was 2.4, but since there has been a sharp decline. During 1955, only six cases were reported for a rate of 0.23, which is a tenfold reduction.

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Increased Incidence of Psittacosis

Total number of cases of human psittacosis reported during the period January 1 to June 9, 1956, is 205 compared to 155 for the same period in 1955. Minnesota, Illinois, North Carolina, and Pennsylvania reported the largest increase in incidence. — *Morb. & Mort. Wkly. Rept., June 15, 1956.*

Chick Sexing

Announcement was made in VETERINARY MEDICINE for April 1956 (page 195) that Poultry Scientist William Seltzer of New Jersey had been granted a patent on a method of treating eggs to control the sex of baby chicks.

The *American Hatchery News* for April 1956 explains the process and how the Vineland Poultry Laboratories have managed to predetermine sex of baby chicks. The United States Patent office has released details of the patented process.

The use of hormones and hormone-like substances by injecting them through the shell of incubating eggs has influenced sex of baby chicks but numerous difficulties and unfavorable results have limited the application of these experimental procedures. The method proposed and patented is both simple and effective but it will likely be sometime before extensive commercial use will be made of it. Questions raised, such as those concerned with sex linked genetic factors, need to be answered.

The process involves nothing more than submerging fertile eggs into a hormone solution for a specified depth and time. One of a number of vehicles for the estrogens has proved successful. Spraying eggs during incubation has also proved successful.

That eggs breathe through shell pores drawing substances into the egg by way of these pores is an acknowledged fact. The hormone treatment procedure makes use of this phenomenon—minute quantities of hormone substance deposited on the shell during dipping are drawn inside the egg, stored, and widely distributed in the external envelopes. The developing embryo then draws on the hormone stored in much the same manner as it draws on the yolk during development. Since the point of incubation when sex determination takes place is not known exactly, treatment prior to incubating or early during the process is required.

Extensive investigations have revealed other significant facts; among these, the influence of vitamins on hatchability. Possibility also exists that the way may be opened toward control of some poultry diseases that are transmissible from generation to generation through the egg.

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Theoretically eggs produced by four mature female ascaris *(Ascaris lumbricoides)* of swine could infect every hog in the United States.— *Upjohn "Facts" Pamphlet.*

PRINCIPLES OF ANIMAL HEALTH

R. R. DYKSTRA, D.V.M.
Manhattan, Kansas

Systemic Parasiticide

Research by USDA scientists, and the Dow Chemical Co. appears to indicate that in Dow Et-57 an agent has been found that will distroy cattle grubs before they can do any damage. The research is still in progress and therefor before this agent may be released it must be determined what if any residue it leaves in the tissues of the treated animals, or in milk produce during or after treatment. The exact safe dosage, and the necessary frequency of its administration is still a matter of research. The chemical is systemic in its action so that the evidence now is that it will kill the grub whatever its location in the tissues, and therefor before any appreciable damage is done by it.

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Silo-disease; Silo-Ensilages Disease (Silo-Fillers Disease — Human)

At various times veterinarians have told us of a diseased condition in animals, especially in cattle and swine, that appeared to be related to the consumption of discolored corn ensilage having an abnormal acidulous odor. Later, after brief aeration, the ensilage appeared harmless. In the Proceedings of the Staff Meetings of the Mayo Clinic of April 4, 1956 (No. 7, Vol. 31) there is a report of two human cases (animals also are mentioned) that from the history appeared to have "silo-fillers" disease, admittedly in a measure a tentative presentation. In both instances the men had been engaged in cleaning out old silos or adding additional ensilage to an already partially filled silo. The outstanding clinical manifestation was a serious pulmonary involvement with cyanosis and extreme dyspnea. Treatment with antibiotics did not result favorably. In both cases a yellowish, "thin haze" was observed low down in the silo. This ensilage is usually of a yellow color.

In the article there is mention of the research work in the University of Wisconsin in which yellow ensilage at the lower levels of the silo contained nitrates and nitrites expressed as 151 parts of nitrogen dioxide (NO_2) calculated on the basis of the air sampled. This gas is considerably heavier than air. If there is a connection, at this time speculative, it calls to the minds of veterinarians the furor caused by several reports of so-called oat hay poisoning in cattle fed on oat hay raised on heavily fertilized soils. By analysis the oat hay contained as much as from 3.6 to 4.91% of nitrate of potash, which when consumed by cattle is changed to nitrite of potash. The latter combines with hemoglobin of the blood changing it to methemoglobin which is not capable of releasing its oxygen to the tissues of the body. Cyanosis, gasping for breath, and sometimes death follows. Veterinarians take advantage of the synergistic action of sodium thiosulfate and sodium nitrite intravenously to relieve symptoms.

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A lay correspondent wrote us about a cow that, following the three latest calvings, was lame in a hind limb while being nursed. After this period lameness disappeared spontaneously. This had us stumped. We thought of the old time "milk-leg" (acute lymphangitis), until we discussed the matter with a colleague who told us of having made diagnosis of rheumatoid arthritis (chronic coxitis) in cases presenting similar history and symptoms. The owner was advised to permit the calf to nurse in the future only so long as the colostrum was present, and after this to hand feed it. The theory regarding the cause is that vigorous nursing of an active young creature may arouse latent pain in the hip.

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According to Mosier, Twiehaus, and Cowan as reported the University of Pennsylvania Veterinary Extension Quarterly of June 15, 1956, Septicemia of Puppies resulting in their early death (before the 10th day of life) is due to an extensive hemorrhagic enteritis caused by pure cultures of *E. coli* or *Pseudomonas aeruginosa* and the *coli aerogenes* group of organisms. The route of infection has not been definitely established, though it could be from infected mammary glands. Early treatment with antibiotics was reported to be encouraging.

PUBLIC HEALTH

JAMES H. STEELE, D.V.M., M.P.H.
Atlanta, Georgia

Salmonellosis

A recent report by White and Meynell in England describes a rare complication of Salmonella infection, osteomyelitis caused by *Salmonella paratyphi C*. Even in typhoid fever, which gives rise to metastatic bone involvment more commonly than any other Salmonella infection, the incidence of osteomyelitis is less than 1% according to the authors. Only two osteomyelitis infections due to paratyphoid B were found among 1,038 cases reviewed. A search of the literature revealed 28 reported cases of Salmonella osteomyelitis other than *Sal. typhi* or *Sal. paratyphi*. These include *Sal. choleraesuis* (17), *Sal. enteritidis* (5), *Sal. typhimurium* (4), *Sal. pomona* (1) *and Sal. oranienberg* (1).

The case which is reported had no recollection of any abdominal pain or diarrhea. The first sign of disease was pain in the patient's left ankle and lower leg which caused difficulty in walking and which kept him awake nights. Following the examination and establishment of *Sal. paratyphi C* as the cause of the osteomyelitis, chloramphenicol therapy was inaugurated which brought about a complete recovery in a short time.

Sal. paratyphi C is a human type infection which is not found in lower animals. It is relatively unknown in the United States but is frequently reported in Europe, Asia, and the West Indies. Jamaica reported 584 cases of paratyphoid in 1952, most of which were type C.

A New Type of Salmonella Infection

Dr. J. E. McCroan, Georgia Department of Public Health, reported an epidemic of food poisoning caused by *Salmonella blockley* which affected hundreds of individuals. There were 123 laboratory confirmed cases. These patients had a serious illness characterized by nausea, chills, fever, vomiting, diarrhea, and severe abdominal pain. About one-half of the more seriously ill were hospitalized, but fortunately no fatalities were identified with this outbreak. There were an additional two hundred or more presumptive cases which occurred in households where there were proved cases. Doctor McCroan estimates that there may have been as many as 3,000 human infections connected with the epidemic.

Investigation revealed that chicken salad processed in a local plant was the vehicle that carried *Sal. blockley*. The organism was routinely isolated from salad in cartons which had been returned after the expiration of the "shelf life." The chicken salad normally remained seven days in the retail outlets before being returned; occasionally some cartons were a month old before they were returned. Physically, there was no change in the salad although the bacteria population in those examined was high.

Five human carriers were found among 18 food handlers in the processing plant. This high carrier rate is believed to have resulted from liberal eating of chicken salad by the employees, who were allowed to bring bread and make sandwiches daily. Doctor McCroan believes that the infection was either introduced by an infected individual or a diseased bird, and spread by bare-hand boning of cooked chicken. The chickens were cooked, and then the meat removed and made into salad without any further heating. The epidemic was terminated by the re-cooking of boned chicken, repeated sterilization of equipment, and control of carriers by therapy.

Salmonella blockley was first isolated early in 1955 from an elderly male patient who was suffering from nausea, vomiting, and diarrhea. It was named after the Blockley Division of the Philadelphia General Hospital, which was the name of the hospital at the time of its founding. Since the original isolation, human cases have been reported in California, Michigan, Georgia and Europe. In recent months *Sal. blockley* has been reported in animals in widely separated areas in the United States and Europe. It appears to have a wide distribution and host spectrum.

Its public health importance is well established by the epidemic reported by Doctor McCroan. Knowledge as to its economic significance as an animal health problem is still to be determined.

VETERINARY NUTRITION

MORRIS ERDHEIM, D.V.M.
Chicago, Illinois

Unidentified Growth Factors — Trace Minerals?

Recent research with sources of unidentified growth factors for chicks has led to curious findings. It has been generally accepted that chicks on conventional diets will grow more quickly and on less feed when sources of the whey factor and the fish factor are added to the diet. There has been some speculation about the nature of these factors. Some of the workers felt that these would likely turn out to be vitamins.

It has now been reported that the ash of these substances will cause a significant growth response. In most cases this response is a major part of the growth response normally expected from these substances. Couch of Texas A & M found that a reconstituted ash which supplied the elements found by spectrographic analysis of the ash of distillers dried solubles (a source of unidentified growth stimulation) produced responses in both chicks and poults which were equivalent to the ash of distillers dried solubles. This suggests that the unidentified factor is of a mineral nature.

Whether this is the beginning of a new discovery in mineral requirements of poultry or an example of imbalance in mineral metabolism remains to be determined.

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Parakeratosis and Calcium

During the past two years a great deal of interest has been stimulated in the role that minerals play in the development of parakeratosis in swine. It appears fairly clear that while other factors may be involved, zinc and calcium play an important part. The higher the calcium levels the greater is the animal's need for zinc. If additional zinc is not available in the feed, parakeratosis may develop. The amount of calcium which nutritionists consider most satisfactory for complete hog feeds (not to be fed with additional grain) is .75% to .9%.

Because the higher levels of calcium may increase the chances of development of symptoms, feed manufacturers may begin to lower the calcium levels in their feeds as a preventive measure. With these new formulas, feeders should be warned to follow feeding directions carefully. If such complete feeds, containing less calcium, are fed with grain, less than enough calcium would be supplied to the animal than is needed for healthy bone formation. This could result in brittle bones and more fractured legs than we have experienced recently.

It would be well for practitioners to check carefully both the feed and the feeding practices in those farms where broken bones are observed. It may be that the feeder is using home grown grains (which are low in calcium) with the complete feed which was not designed to be fed with grains. If a supplement is being fed, it may be that much more grain is being fed with it than the feeding program intended.

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Antivitamins

The *Journal of Vitaminology* is published in Japan for the Vitamin Society of Japan. (It is written in English). The March 10, 1956 issue carried a series of interesting papers on thiamine deficiency due to bacterial thiaminase. "Thiaminase disease" was described in man in whose intestines *Bacillus thiaminolyticus* was found. This organism proliferates abundantly producing thiaminase which inactivates thiamine, leading to a thiamine deficiency.

Since the condition is not found in suckling infants, it was presumed that lactic acid bacteria would alleviate the condition. Subsequently, Lactobacillus therapy has become one of the approaches to treatment. The other is the use of homosulfanilamide. This sulfonamide appears to be the only one effective against the causative agent.

Another paper in the same issue describes "thiaminase disease" in chickens. In this paper, three thiaminase producing organisms are described: *Bacillus thiaminolyticus, Bacillus anuerinolyticus, Clostridium thiaminolyticus.* The most significant symptom is motor paralysis of the extremities. In the early stages, a lameness is manifested which results in difficulty in walking.

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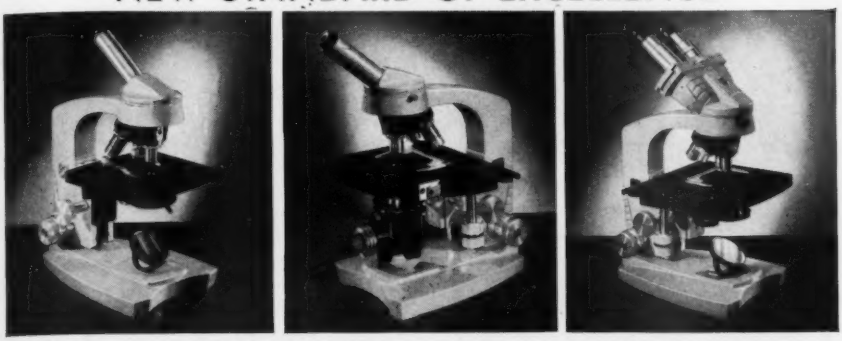
Sows' milk tests between 7% and 9% fat. Orphan pigs may be raised on cow's milk to which butter fat was added to make a 7% to 9% level.—*H. C. H. Kernkamp, D.V.M.*

NEW STANDARD OF EXCELLENCE



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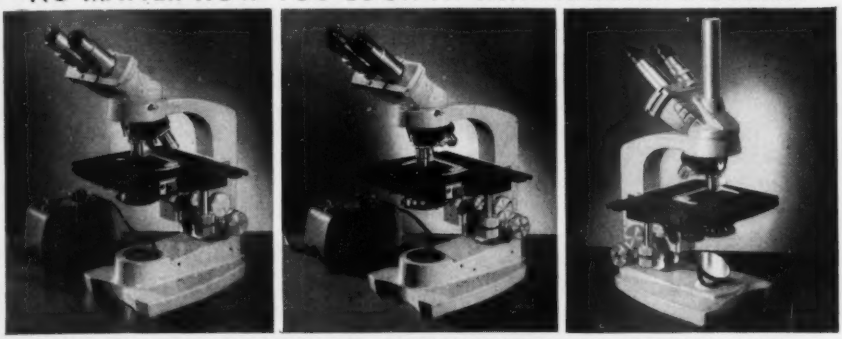
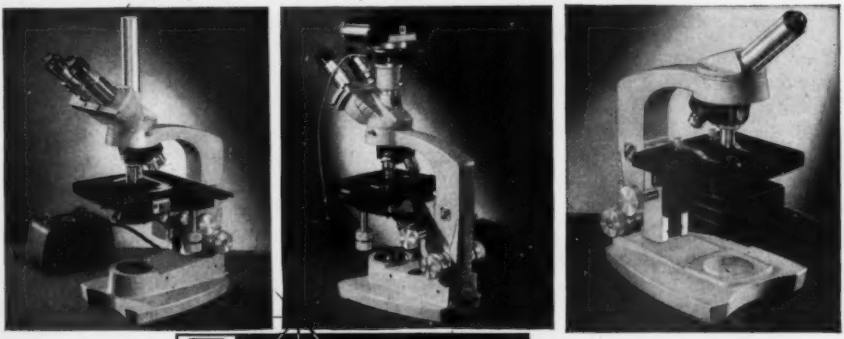


MONOCULAR, BINOCULAR, TRINOCULAR...WHATEVER USE...



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POULTRY PRACTICE PROBLEMS

W. R. HINSHAW, D.V.M., Ph.D.
Frederick, Maryland

Toughness in Frozen Poultry

The frozen poultry business has a new problem commonly called the "toughness factor." Consumers of frozen turkeys and chickens have been complaining about increased toughness. Preliminary investigations indicate that this toughness may be caused by speed-up in modern processing which prevents normal aging of birds before freezing. Research suggests that birds should not be frozen for at least 20 hours after they are dressed. Aging after thawing of birds frozen immediately after dressing seems to accomplish the same results. Controlled research on this problem is now in progress at the USDA Western Utilization Branch at Albany, California in cooperation with the Institute of American Poultry Industries, the Refrigeration Research Institute and the National Turkey Federation.

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Infrared Lamps for Brooding Chicks

The USDA, Agriculture Research Service, in recognition of the popularity of infrared lamps for brooding chicks has published Leaflet 397 on this subject. Advantages given for this system include the facts that there is no fuel to carry, no ashes to remove, and no burners to clean. The authors also state that these brooders are light in weight, easy to set up, move and store and that the chicks can be seen without lifting a hover. The leaflet giving complete instructions is available from the Office of Information, USDA, Washington 25, D. C.

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According to the *American Hatchery News* (Feb. 1956), the USDA Crop Reporting Board estimates the nation's egg production for 1955 at 67,300,000,000 eggs. This is 3% more than the previous high record of 1954 and 16% above the 1944-53 average. The annual rate per layer was 188 eggs compared to 184 in 1954 and the average of 166. The four leading egg producing states in the order given were Iowa, California, Pennsylvania and Minnesota.

"Naked Eggs"

Dr. L. B. Darrah, poultry marketing specialist Cornell University, has developed an idea of marketing eggs without shells in 12-compartment polyethylene packages. He maintains that these "naked eggs" will be as good as eggs in shells and should be cheaper. The eggs are prepared without human hands touching them. A machine breaks the eggs and drops them into individual cup-like compartments. A whiff of carbon dioxide is added to maintain quality and the compartments are sealed mechanically with a strong film. Cornell University is planning a marketing acceptance test of the new method by placing the packaged "naked eggs" in selected Ithaca stores.

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Use Your Diagnostic Laboratory

A large number of remedies that can be given to poultrymen with confidence that they will help reduce mortality are now available. It must be emphasized, however, that successful medication depends on an accurate diagnosis early in an outbreak. Veterinarians are urged to make use of the well equipped diagnostic laboratories that are now available as aid to them in making this diagnosis.

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Hydrated lime, according to Yushok and Bear (New Jersey Agr. Exp. Sta. Bul. 707, 1944), when used as a preservative and deodorizing agent for poultry manure also has value as a partial disinfectant. Mixed with fresh manure at the rate of 200 lb. per ton of manure, it was found to have a bactericidal effect on *Salmonella pullorum, Salmonella typhimurium, Salmonella gallinarum,* and *Pasteurella multocida* in a 15-minute period. Similarly it prevented the sporulation of coccidial occysts, and the segmentation and embryonation of *Ascaridia lineata* eggs. Another advantage of this use pointed out by them is that the treated manure is unattractive to flies and rodents. Fly maggots are not produced in the treated dropping pits, and both mice and rats avoid them.

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Stilbestrol for Fattening Cattle

Questions are still being raised about the possibility of diethylstilbestrol being present in the meat of cattle fed this agent as an adjuvant in feeding practices. The evidence against this is that when cattle, during the full feed period, receive as much as 10 mg. per day, only 0.6 parts per billion is contained in the tissues by the time the animals are ready for marketing.. This is an infinitesimal amount and is not a hazard from the standpoint of those consuming the meat.

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Brown, W. J.: J.A.V.M.A., May, 1950. *Irwin, W. F.:* Southwestern Vet., May, 1950.

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PROFESSIONAL BOOKS: Brumley's Diseases Small Animals $5. Kirks's Index of Diagnosis $9.; of Treatment $10. Black's Vet'y Dictionary $9. Bradley's Dog Anatomy $4.50. Hobday's Surg. Diseases Dog & Cat $7. Hadley's Principles Vet's Science $7. Judy Publ'g Co., 3323 Michigan Blvd., Chicago 16.

VETERINARIAN WANTED: With some experience, for small animal hospital. Good salary, apartment available. Owen Animal Hospital, 7737 Gratiot Ave., Detroit, Mich.

UNUSUAL OPPORTUNITY: For young veterinarian with foresight, to take over small practice. I have other interests. Requirements: experience, assertive, and a Kentucky license. Address No. 319, care VETERINARY MEDICINE.

WANTED: Recent graduate of recognized school to work in mixed practice in Eastern New York state. Good home and good wages. Address No. 320, care VETERINARY MEDICINE.

VETERINARIAN: Immediate opening for veterinarian in Veterinary-Medical Division for clinical research work and related professional services. Practical experience desirable. Some travel involved. Please forward resumes to Personnel Director, Eaton Laboratories Division of The Norwich Pharmacal Company, Norwich, New York.

WANTED: January and March, 1956 issues of VETERINARY MEDICINE. Your subscription will be advanced one month for each copy. Mail to VETERINARY MEDICINE, Suite 803 Livestock Exchange Bldg., Kansas City 2, Missouri.

WANTED: Capable veterinarian to operate large animal established practice on precentage basis. Guaranteed $5000. with opportunity to double that amount. Opportunity offers a secure future for right man. Opening available immediately. Address Box 321. care VETERINARY MEDICINE.

After a decade of near disregard of food flavor as a significant factor tempering demand, the dairy industry is becoming flavor-minded.

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A 14-page booklet entitled, Lets Get the Cows Up Off the Floor, is designed to help dairymen cut their labor cost and increase production per manhour. Suggestions made are quite likely to be useful "business tips." The booklet is "available literature." Free copies will be mailed in response to requests. Write Babson Bros. Co., (Makers of Surge), 2843 W. 19th Street., Chicago 23, Illinois.

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PROVED USE IN

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Dr. Paul J. Brandly Heads Biological Control Work of Federal Meat Inspection

Dr. Paul J. Brandly has been selected to head the newly formed Biological Control Section in the Meat Inspection Branch of the U. S. Department of Agriculture with headquarters at the Agricultural Research Center, Beltsville, Maryland.

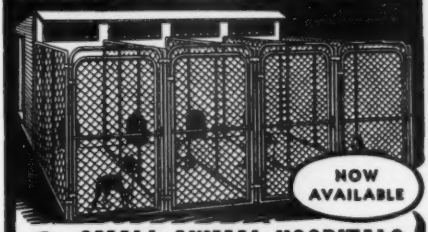
This Section gives scientific direction and laboratory service in dealing with problems of meat inspection involving the biological sciences, with special emphasis in the fields of

Dr. Paul J. Brandly

microbiology, pathology, parasitology, and serology. The Chemical Control Section (formerly the Laboratory Section), which operates seven field laboratories, continues to deal with meat inspection problems involving the physical sciences. The work for meat inspection formerly done by the Pathological and Zoological Divisions of the old Bureau of Animal Industry is included in the work of the new Biological Control Section.

Doctor Brandly, a native of Kansas, received his D.V.M. degree from Kansas State College in 1933. Except for a few years in private practice, in graduate study, and in charge of veterinary public health activities of the U. S. Public Health Service in Alaska, his entire career has been spent in USDA poultry and meat inspection activities. Since 1952, he has served as food bacteriologist in the office of Dr. A. R. Miller, chief of the Meat Inspection Branch. Doctor Brandly's work on meat inspection problems includes an improvement of a serological means for identifying meat from different animals.

MASON'S *New* KENNEL RUNS



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Dr. Paul Brandly

(Continued from page XXXIII)

Identifying pathological and bacteriological changes in meat and testing various control methods for making meat safe where parasites are involved are part of the work of the new Section. Changes in processing methods and meat-packing procedures, including the large increase in prepackaging of foods, have brought about a need for evaluating such methods to assure safety.

The Section devises ways of determining whether cleaning and sanitizing procedures are adequate to control pathogenic or food spoilage organisms. It devises laboratory procedures for identifying the presence of therapeutic agents and growth-promoting substances.

No research is conducted by the Meat Inspection Branch. However, Doctor Brandly and his coworkers will determine and evaluate scientific data necessary to establish the biological safety and suitability of processing methods for meat and meat food products. They will direct such investigations by packers, suppliers, or research organizations as are needed to assure that additives or processing procedures are biologically acceptable so that the public is protected.

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EXCLUSIVELY FOR THE VETERINARY PROFESSION

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MASTITIS FORMULAE FOR THERAPY AND PROPHYLAXIS

AT REDUCED PRICES!

✳ WITH PAPAIN ADDED

. . . dissolves clots . . . improves drainage . . . for freer access of antibiotics to infected areas

USC 500-100

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A PROPHYLACTIC MASTITIS FORMULA

POWERFUL ENOUGH FOR THERAPEUTIC USE

Each 11cc liquid base tube or syringe contains:
500,000 U. Cryst. Penicillin Potassium G
100 mg. Dihydrostreptomycin (as sulfate)
500 mg. Sulfamerazine, Microcrystalline
500 mg. Sulfathiazole, Microcrystalline
7.5 mg. Cobalt Sulfate
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11cc TUBES	$ 3.90 per doz.	32.5¢ per tube
in 1-gross lots	41.76 per gross	29¢ per tube
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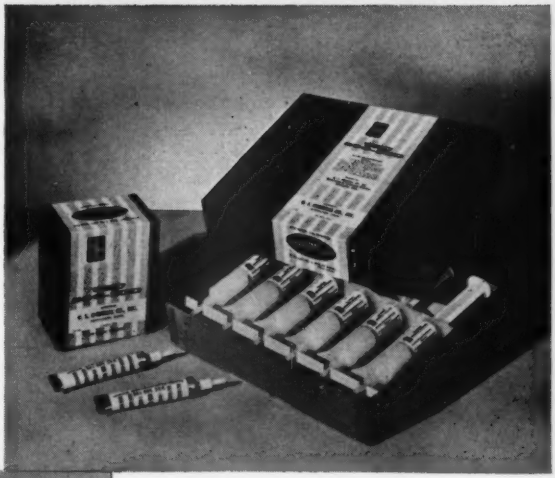
in 1-gross lots	57.60 per gross	40¢ per syringe
in 3-gross lots	54.72 per gross	38¢ per syringe
in 5-gross lots	52.56 per gross	36.5¢ per syringe



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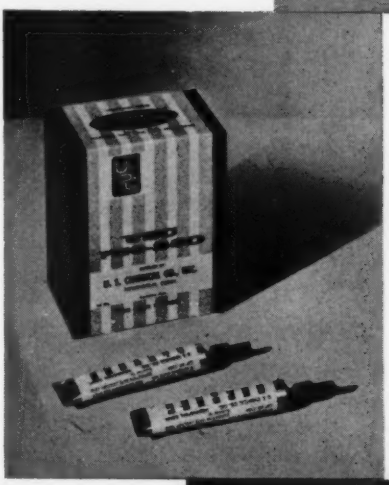
U.S. Chemical's mastitis preparations are now colorfully packaged in new, sturdy, modern-designed boxes of twelve. Each formula is packaged in an individual color, to provide absolute control in dispensing and administering; imprinted with Doctor's name on orders of one gross or more.



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500 mg. Sulfathiazole, Microcrystalline
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11cc TUBES	$ 4.92 per doz.	41¢ per tube
in 1-gross lots	51.84 per gross	36¢ per tube
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Each 28cc liquid base tube contains:
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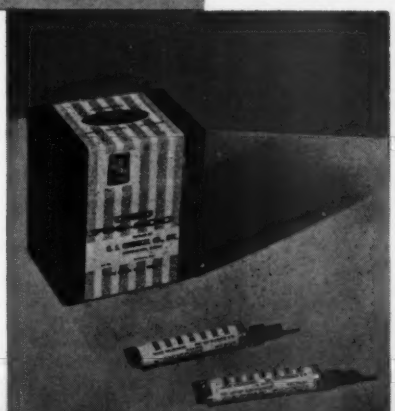
750 mg. Sulfamerazine, Microcrystalline
750 mg. Sulfathiazole, Microcrystalline
7.5 mg. Cobalt Sulfate
50 mg. PAPAIN

28cc TUBES	$ 5.94 per doz.	49.5¢ per tube
in 1-gross lots	64.80 per gross	45¢ per tube
in 3-gross lots	59.04 per gross	41¢ per tube
in 5-gross lots	56.16 per gross	39¢ per tube



USC's famous base allows a faster release of antibiotics from the base to the infected areas—thus allowing a maximum amount of therapy in a minimum amount of time.

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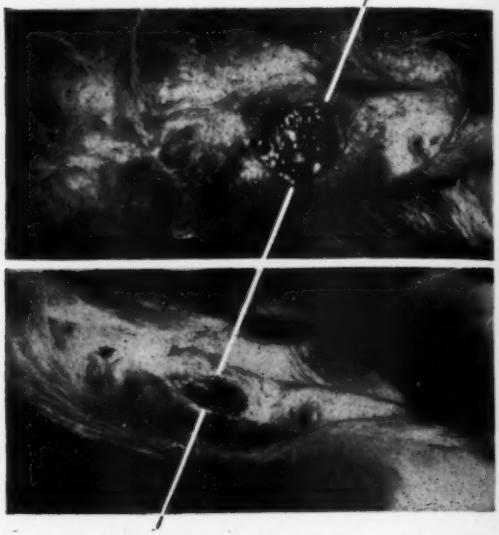
For large and small animals

TRYPTAR *vet*

ARMOUR

for selective physiological debridement of necrotic tissue



TRYPTAR vet (Armour) may be used whenever debridement or removal of necrotic tissue is desired. It has been found to be effective in the following conditions:

- **Osteomyelitis**
- **Surface ulcers**
- **Soft tissue abscesses**
- **Foot rot (bovine)**
- **Paranasal sinusitis**
- **Suppurative bursitis (fistulous withers)**
- **Suppurative arthritis**
- **Foot canker (equine)**
- **Purulent and gangrenous mastitis**
- **Pyometra and metritis**
- **Suppurative otitis**
- **Infected compound fractures**
- **Infected amputation stumps**

Tryptar rapidly dissolves fibrinous strands, surface coagula and clotted blood of necrotic lesions. The purulent exudate and necrotic tissue are also attacked. When the necrotic tissue has been penetrated, serum starts to flow from adjacent healthy tissue, floating away the digested debris. The exudate becomes serous and normal-appearing leukocytes replace pathological leukocytes. With continued treatment exudation gradually ceases and fresh, healthy granulation tissue appears.

Package information: TRYPTAR vet (Armour) is supplied as a white crystalline powder in vials containing 200,000 Armour units. It is stable indefinitely in dry form at room temperature.

ARMOUR

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the positive answer to your disposal problems . . .

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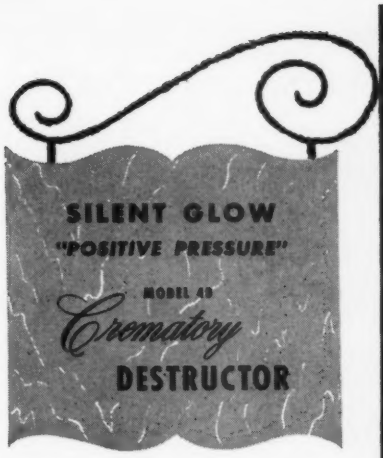

This Crematory **DESTRUCTOR** is the *only* type that is positively fulfilling every health and sanitation requirement by completely destroying small animal and poultry carcasses, kennel waste, laboratory and hospital refuse to a white ash with "positive pressure", odorless and smokeless operation without a chimney.

The Crematory **DESTRUCTOR** improves neighborhood relations with its smokeless, odorless, sparkless operation. Immediate disposal of carcasses and waste material eliminates the need for refrigerated storage equipment, unsanitary refuse cans and scavenger truck pick-up service . . . permitting "hospital clean" maintenance of premises.

The compact **DESTRUCTOR** is easy-to-use, attractively designed and completely weatherproofed for installation in outdoor locations and environments.

Write today for list of distinguished **DESTRUCTOR** owners, which includes noted Veterinarians, Government Agencies, Humane Societies, Laboratories, Pet Hospitals, Kennels and Animal Farms.

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For further details mail this advertisement with your letterhead.

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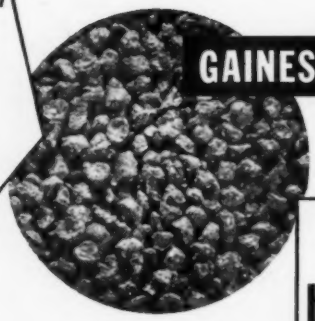


GAINES MEAL

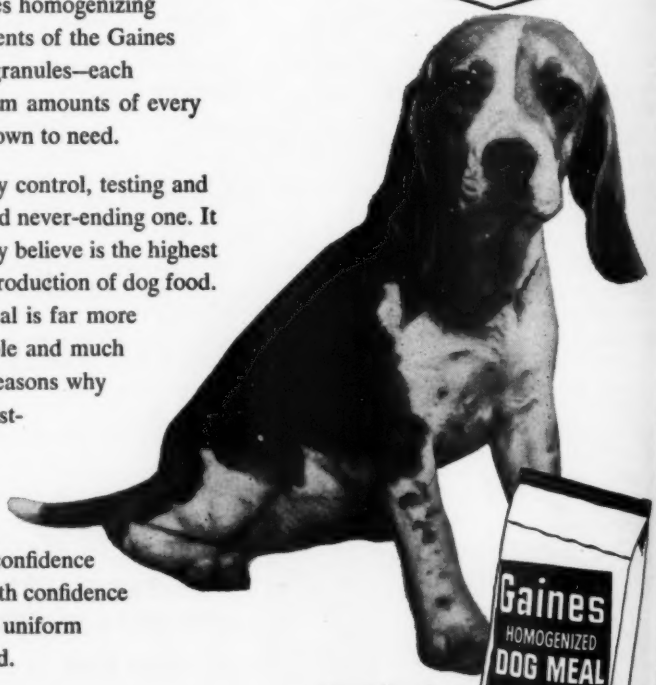
makes a big difference here...

Yes, Gaines makes the difference

because the special Gaines homogenizing process combines ingredients of the Gaines formula into appetizing granules—each granule containing uniform amounts of every food element dogs are known to need.

Gaines program of quality control, testing and research is an exacting and never-ending one. It results in what we honestly believe is the highest standard possible in the production of dog food. Gaines Homogenized Meal is far more assimilable, more palatable and much easier to feed . . . good reasons why Gaines is America's largest-selling dog meal.

Gaines indeed makes the difference . . . you can use Gaines with confidence . . . recommend Gaines with confidence . . . because complete and uniform nourishment is guaranteed.



A Product of General Foods

Gaines ***HOMOGENIZED*** **DOG MEAL**

Lilly Research Center

A $3,000,000 expansion program in agricultural research was announced recently by Eli Lilly and Company, of Indianapolis.

Lilly will construct an agricultural research center to be located on 417 acres at Greenfield, Indiana, present site of the Lilly Biological Laboratories.

Construction will begin by midsummer, according to Dr. T. P. Carney, Lilly vice-president in charge of research, development, and control. One to two years will be required to complete the dozen building units.

The comprehensive Lilly research center will include the following: Administration building, plant disease laboratories, greenhouses, veterinary research laboratories, cattle feeding barn, swine farrowing house, swine nursery, swine research barn, sheep barn, caged layer house, broiler plant, and centrally located feed-mixing plant.

The Lilly agricultural research program will touch nearly all phases of agriculture—animal nutrition, veterinary medicine, insects and insecticides, and plant nutrition and diseases.

Lilly veterinary research will be closely coordinated with activities of Corn States Laboratories, Inc., of Omaha, a recently purchased subsidiary.

Along with this expanded research program, Lilly is co-operating with leading agricultural colleges, experimental stations, and other organizations in numerous agricultural projects.

▼ ▼ ▼

By adding nystatin (mycostatin)®, an antifungal antibiotic product of E. R. Squibb & Sons, to the virus cultures for production of foot-and-mouth disease vaccine, the troublesome problem of yeast contamination has been resolved. It is claimed that addition of this antibiotic does not interfere with virus multiplication.

Treatment for Mismated Bitches

Inject 0.5 mg. reposital® diethylstilbestrol per pound body weight immediately after mismating. Disadvantage of the treatment is the tendency to prolong estrum.—*Wm. F. Jackson, D.V.M.*

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Remarkable SAFE Biologic

With Anti-Bacterial, Fungal

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Preparation

The fast-acting **NON-TOXIC** antibiotic and fungicide that may be used safely on dogs, cats and all domestic animals. Topical application, greaseless, safe, does not stain. Easily applied, readily absorbed into the skin where it gets at the roots of bacterial, fungal, allergic or skin conditions of undetermined nature, including SUMMER ECZEMA.

MALUCIDIN* Preparation has exceptional therapeutic action and cleaning properties and may be used as a most effective and economical surgical scrub.

MALUCIDIN* Preparation Treats:

★ Fungous Skin Conditions
★ Moist and Dry Eczema (Hot Spots)
★ Ringworm
★ Elephant Skin
★ Nondescript Dermatitis
★ Itching or Irritated Skin
★ Interdigital Cysts
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To Treat Ectoparasites on Dogs, Add 1 Part 5% Emulsifiable Rotenone (available from us) to 9 Parts MALUCIDIN*; 1:20 for Cats.

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are for those who enroll in the Nation-Wide D.V.M. "Silent Partner" Plan.

It is basic to the Accident and Sickness insurance needs of every veterinarian, regardless of any other insurance he may carry.

With this plan, policyholders share in the economies of Nation-Wide, Mass Purchasing Power and in reduced cost of administrative work and selling expense.

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State association members are cordially invited to "Accept" and to participate in the Nation-Wide D.V.M. "Silent Partner" Plan, thereby making available an opportunity to all of their active members up to age 70, regardless of past medical history, provided the state enrollment is obtained.

Write for details.

Silent Partner Associates, Inc.
Veterinary Department
P. O. Box 24
Evanston, Illinois

Dr. E. J. Hoff Joins Schering

Dr. Edwin J. Hoff, has been appointed to the Veterinary Medicine Department staff of Schering Corporation, Bloomfield, New Jersey pharmaceutical manufacturers. The Veterinary Medicine Department is under the direction of Dr. J. C. Siegrist.

Dr. E. J. Hoff

Dr. Hoff has been associated at the New York State Veterinary College Regional Laboratory in Kingston, New York. He served with the United States Army Signal and Air Corps for six years, including four years service during World War II. Following his release from the Army, he took two years of premedical training at Cornell University. After completing his preliminary training, he attended New York State Veterinary College from which he received a Doctor of Veterinary Medicine degree in 1952.

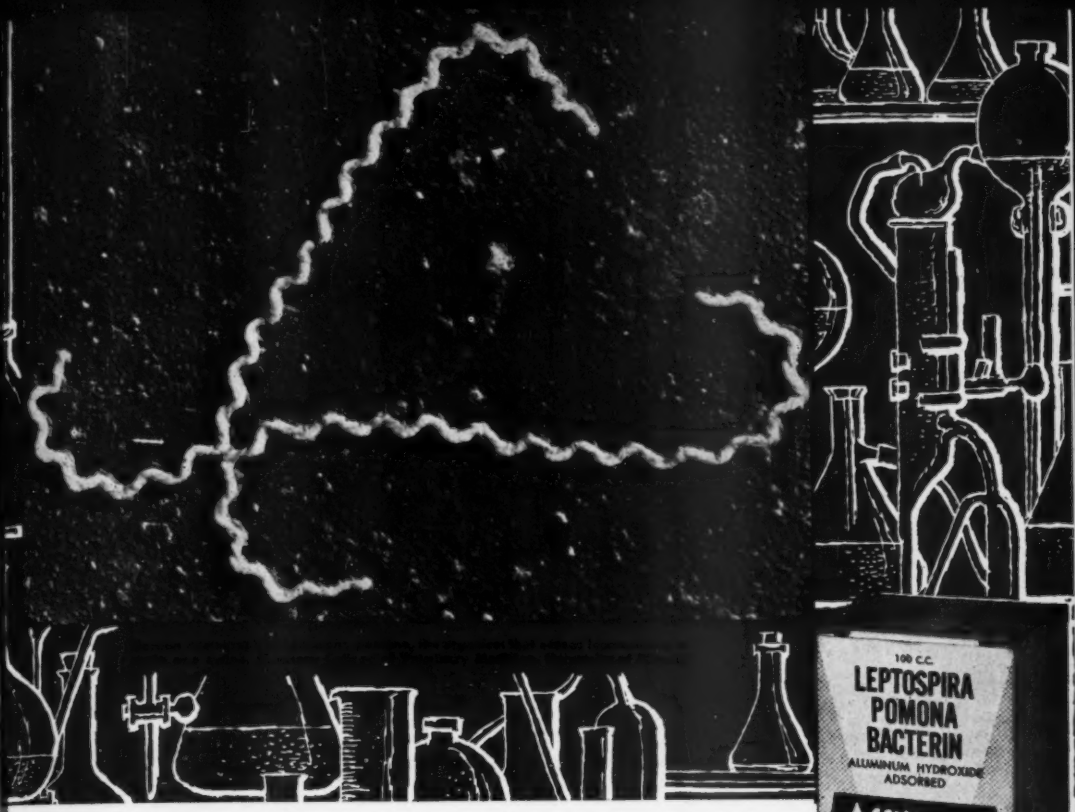
Doctor and Mrs. Hoff and their three children are presently living at 87 Lincoln Street, Kingston, New York.

▼ ▼ ▼

Only minor difference, were noted in a three year trial testing the nutrient value of a group of cultivated pastures. Kentucky bluegrass, bromegrass, and orchard grass were approximately equal in value; Kentucky 31 fescue failed to equal the grasses mentioned above with which they were compared. *Jour. Dairy Sci., May 1956.*

▼ ▼ ▼

Dairy scientists at the Pennsylvania station found that one of three groups of pail-fed calves exhibited superior growth when compared to nipple-fed calves. In the other groups difference werenegligible. *Jour. Dairy Sci. May 1956.*



Tests show NEW Affiliated Brand Leptospira Pomona Bacterin gives protection against highly virulent Leptospira pomona.

Supplied in following convenient packages: 25cc bottle, 50cc bottle, 100cc bottle and 250cc bottle

- For the first time adsorbed with aluminum hydroxide for the special advantages it offers
- May be administered at the time of hog cholera vaccination or with any other biologics
- Controls spread of leptospirosis when used on infected herds

Leptospirosis, designated as one of the four major diseases of cattle in this country, is readily spread from cattle to cattle or swine to swine. Also it is commonly transmitted from one species to another. Apparently swine play an important carrier role and frequently are a source of active infection for susceptible animals coming in contact with them. In a four year survey by the University of Illinois "Lepto" was found in 34 percent of the cattle herds and in 32 percent of the swine herds tested. For best prophylactic treatment, Leptospira Pomona Bacterin should be used prior to exposure to the infection. **Immunity develops about seven days after injection with the new bacterin.**

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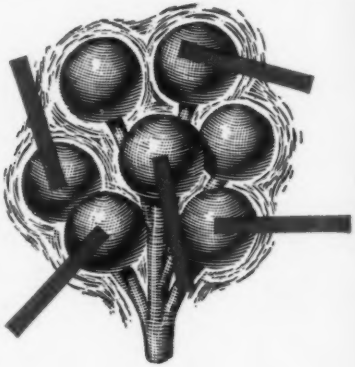
PRODUCED FOR AND SOLD TO GRADUATE VETERINARIANS ONLY

The FIRST effective treatment against BOTH the inflammation and infection of mastitis

...CORBIOT*

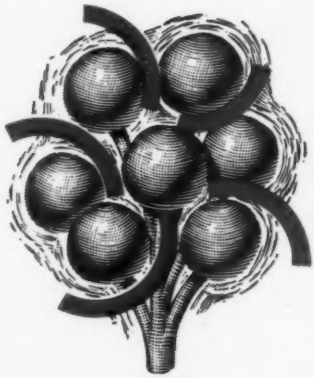
against the infection

potent antibiotic combination, with the synergistic and additive actions of NEOMYCIN, PENICILLIN, *and* POLYMYXIN *to attack Gram-negative and Gram-positive organisms infecting the udder.*



against the inflammation

for the first time, potent anti-inflammatory action of CORTEF* *(hydrocortisone acetate) to reduce swelling, minimize scarring, and help maintain milking volume.*



Teatube*-CORBIOT*

Available in single-dose, 10 gram, collapsible, applicator Teatube. Packed singly and in dozens. Each tube contains 20 mg. hydrocortisone acetate (CORTEF), *250 mg. neomycin sulfate (equiv. to 175 mg. base), 250,000 units procaine penicillin G, 50,000 units polymyxin B sulfate, and 50 mg. chlorobutanol in a special, milk-miscible base.*

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*TRADEMARK, REG. U. S. PAT. OFF.

Special INTRODUCTORY OFFER

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Vistrepcin

PATENT PENDING

A water dispersible Penicillin-Streptomycin-Vitamin powder that has shown impressive field results. Vistrepcin is a highly dispersible drinking water additive that can be used at both nutritional and treatment levels for swine, poultry and calves.

10-1 pound bottles } only $21.50
or 2-5 pound bottles } ($2.15 per lb.)

PLUS 2 POUNDS FREE

THIS BRINGS THE PRICE PER POUND DOWN TO $1.79

TRY THE TWO POUNDS, AND RETURN THE TEN POUNDS FOR A FULL REFUND IF YOU ARE NOT COMPLETELY SATISFIED.

ADDITIONAL SAVINGS THROUGH QUANTITY BUYING

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100 Pounds 10%

Two Pounds FREE With Each 10 Pounds Purchased

FILL OUT THIS FORM AND MAIL TO: Diamond Laboratories
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Indicate quantity in multiples of 10 pounds. (Do not include free bottles.)

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NAME.....
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CITY..... STATE.....

can help stop losses from milk rejections and the slaughter of good cows. Write TODAY for a full size box — FREE.

Sterling Research Corp.
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Quick relief for Bone, Bursal or Tendon Lameness

Single Bottle.....$2.00
3 and 1 free.....5.00
6 and 2 free.....9.00
12 and 4 free.....17.00
24 and 4 free.....28.00

CARTER-LUFF CHEMICAL CO.
Hudson, N. Y.

Hereditary Predisposition to Uterine Prolapse

Vaginal and uterine prolapse in Hereford cattle is the subject of a project conducted by Woodward and Quisenberry of the USDA. The project was carried on in Montana. The selection of Hereford cattle for this project is based on a general belief shared by many veterinarians that the matter of prolapse is observed relatively more frequently in Herefords than in other breeds of cattle. The observation of the author is that prolapse occurs most frequently at the time of first calving and after animals reach seven years of age. Furthermore, it is stated that, "significant line differences in the incidence of prolapse suggest a hereditary susceptibility for this characteristic." If the foregoing tentative deduction is accepted, then as the authors state: "It would follow that it . . . could be controlled to some degree by rigorous culling." Also the evident relationship between nutritional deficiencies and the incidence of prolapse should be studied more thoroughly.

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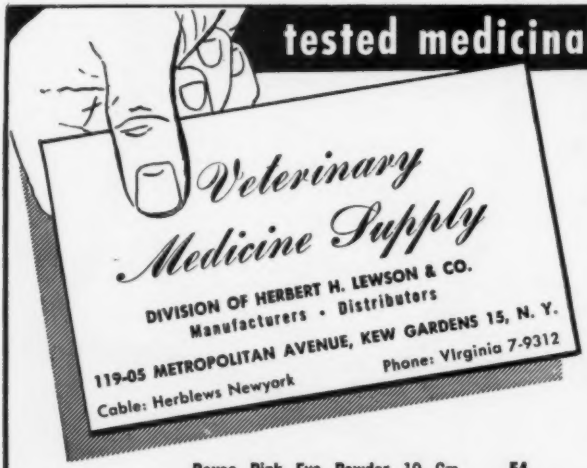
The roster of the American Association of Veterinary Nutritionists now numbers 135 veterinarians.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Controlling the worms in cattle with new Pheno-Fortified Salt

Q. Why is worm control now important for beef and dairy cattle as well as sheep?

A. Research findings show that the great majority of beef and dairy animals also carry stomach and intestinal worms. Some infections are heavy and others are relatively light, and clinical symptoms may not always be apparent. But the condition is present—and it is costly everywhere, even in cold areas where winters were thought to suppress parasites. By USDA estimates, worms in cattle are now costing close to $40 million annually—almost equal to the figure for sheep.

Q. What new control program is being recommended?

A. After veterinary diagnosis, a worming dose or doses of phenothiazine should be given to young dairy animals, beef stock, feeder steers, or sheep. Then animals should be put on a *consistent low-level program* which supplies daily amounts of pheno. Long used for controlling worms in sheep, this practice has also proved effective in preventing cattle from becoming reinfected.

Q. Why is phenothiazine in salt especially effective for low-level feeding?

A. Because salt, an ideal carrier for pheno, is needed every day of the year by livestock; and because salt fits any feeding program. One of the best commercial products for this type of program is Sterling Green'salt—produced by the International Salt Company. Fed free choice or as the salt in feed, Green'salt has proved to be an ideal product for low-level control. It contains salt, 10% pheno, and the six essential trace minerals: iodine, cobalt, iron, copper, manganese, and zinc—as well. Daily intake of Green'salt per head should be about two tablespoons for adult cattle, one-half tablespoon for sheep.

CATTLE-GRUB CONTROL: Two-year tests at the U. S. Regional Animal Disease Control Laboratory, Auburn, Ala., show that pheno (in a mixture with salt) fed free choice can result in considerably lighter infestations of cattle grubs. Treated animals had one-eighth as many grubs as the untreated.

For further information and references, write: International Salt Co., Inc., Scranton, Pennsylvania.

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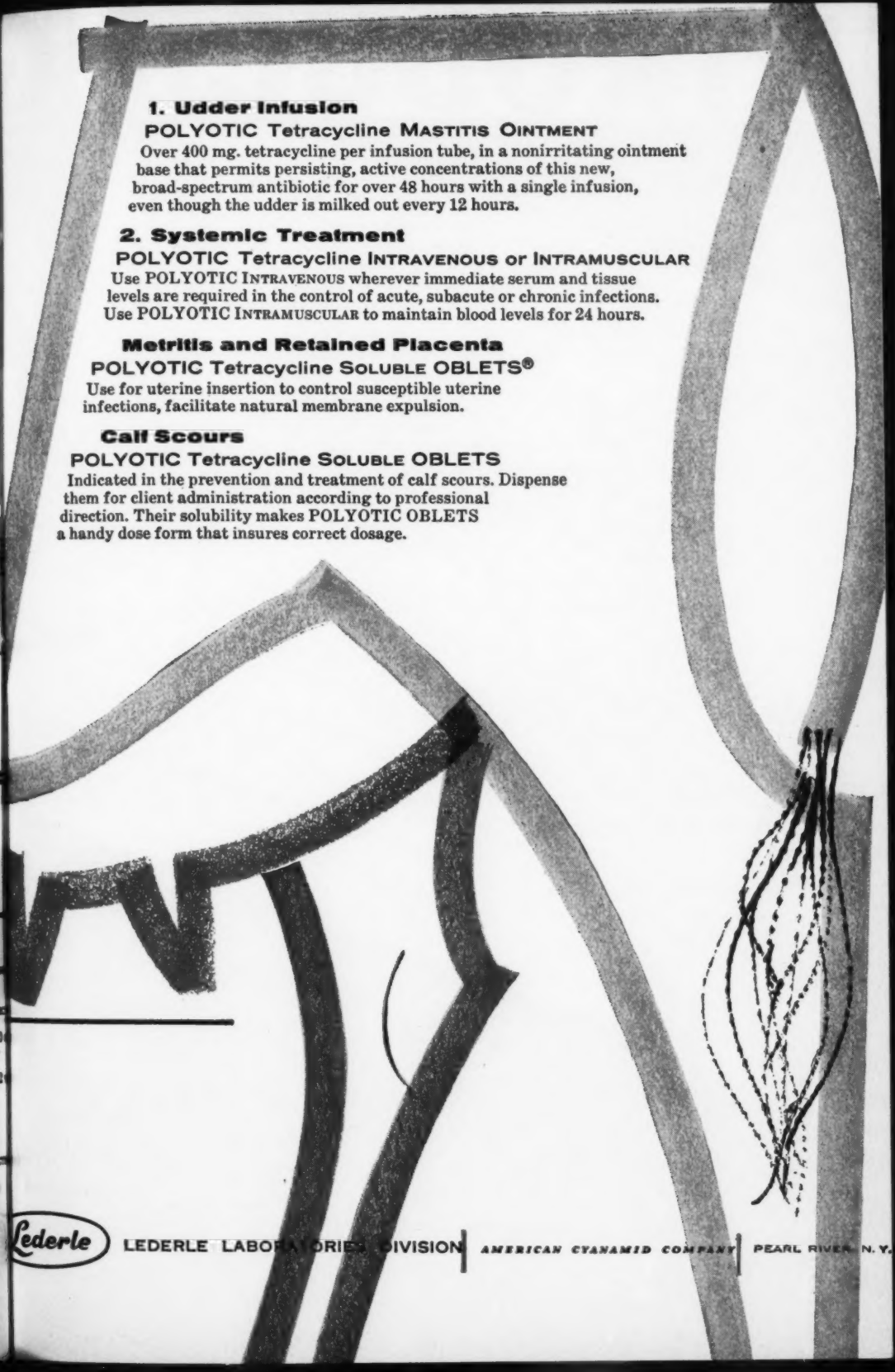

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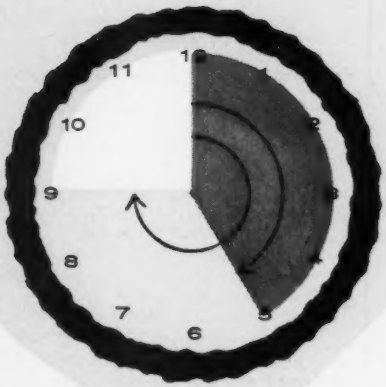

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MEETING CALENDAR

Alabama Polytechnic Institute Annual Conference for Veterinarians. School of Veterinary Medicine, Alabama Polytechnic Institute, Auburn, Ala., July 22-25, 1956. R. S. Sugg, dean.

Michigan State University College of Veterinary Medicine. Conference on radiology for veterinary practitioners. Kellogg Center, M.S.U. campus, East Lansing, Mich., August 7, 1956.

Pennsylvania State University. Annual Health Conference. State College, Pa., August 21, 1956. Dr. Ernest J. Witte, Chief, Division of Veterinary Public Health, Harrisburg, Pa.

Louisiana Veterinary Medical Association. Regular meeting. Jung Hotel, New Orleans, La., Aug. 30-31, 1956. William H. Lockard, Jr., secretary.

Pennsylvania State Veterinary Medical Association. Annual meeting. Bedford Springs Hotel, Bedford, Pa., September 12-14, 1956. Raymond C. Snyder, N.W. Corner Walnuts St. and Copley Rd., Upper Darby, Pa., secretary.

Northeast Mississippi Veterinary Medical Association. Annual Clinic with Dr. W. L. Stroup. Stroup Animal Clinic. Corinth, Miss. Tuesday, Sept. 12, 1956. James H. Nelson, Box 372, Baldwyn, secretary.

Washington State Veterinary Medical Association. Annual meeting. Davenport Hotel, Spokane, Sept. 21-22, 1956. P. J. Pfarr, 6306 N. Wall, St. Spokane, general chairman.

Oklahoma Conference for Veterinarians. School of Veterinary Medicine, Oklahoma A & M College, Stillwater, September 27-28, 1956. A. L. Malle, Department of Veterinary Pathology, chairman.

Eastern Iowa Veterinary Association. Annual meeting. Hotel Montrose, Cedar Rapids, Ia., October 4-5, 1956. Forrest B. Brutsman, Traer, secretary.

University of Missouri. Thirty-second annual Short Course for graduate veterinarians. Columbia, Mo., Oct. 1-2, 1956. Dr. Cecil Elder, chairman.

Purdue University. Forty-fourth Annual Short Course for Veterinarians. Purdue University, Lafayette, Ind., Oct. 3-5, 1956. L. M. Hutchings, chairman.

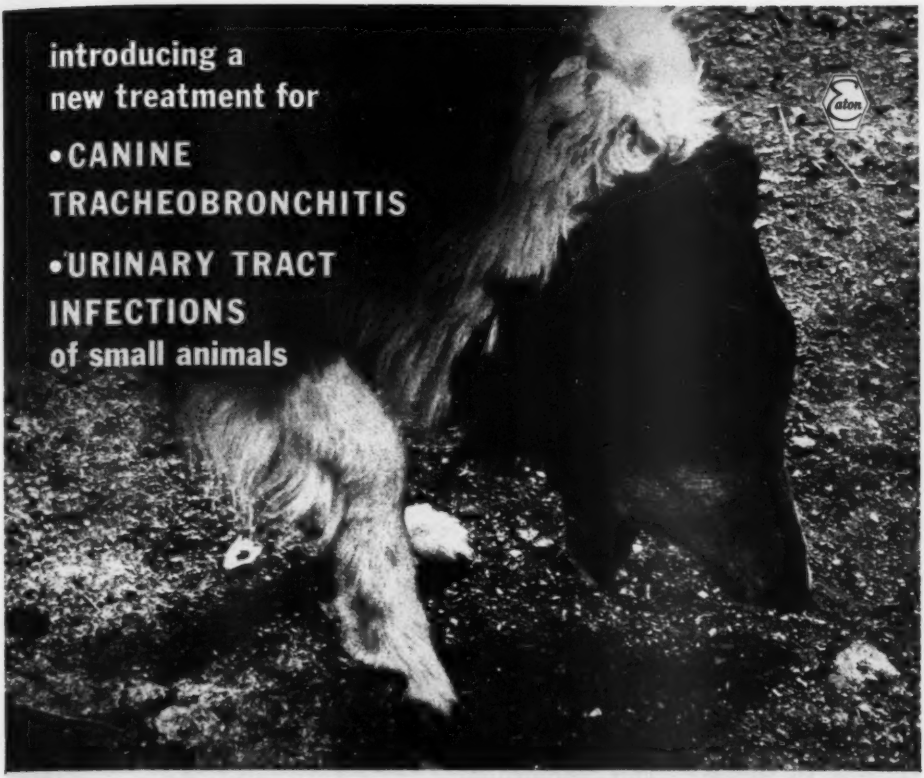
South Dakota Veterinary Medical Association. Annual meeting. Hotel Cataract, Sioux Falls, S. Dak., Oct. 4-5, 1956. Dr. J. L. Noordsy, Marion, S. Dak., secretary.

American Veterinary Medical Association. Annual meeting. Municipal Auditorium, San Antonio, Tex., October 15-18, 1956. J. G. Hardenbergh, 600 S. Michigan Ave., Chicago, Ill., executive secretary.

Southern Veterinary Medical Association will hold their 1956 Annual meeting in conjunction with the American Veterinary Medical Association convention at San Antonio, Texas, Oct. 14-18, 1956. Dr. A. A. Husman, Raleigh, N. C., secretary.

United States Livestock Sanitary Association, 60th annual convention, Hotel Morrison, Chicago, Ill., Nov. 28-30, 1956. Dr. R. A. Hendershott, 33 Oak Lane, Trenton 8, N. J., secretary.

New York State Veterinary College. Forty-ninth Annual Conference for Veterinarians. Cornell University, Ithaca, N. Y., Jan. 2-4, 1957. W. A. Hagan, dean.



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1. Mosier, J. E.: Vet. M. 50:605, 1955. 2. Breakey, R. S.; Holt, S. H., and Siegel, D.: J. Michigan M. Soc. 54:805, 1955.

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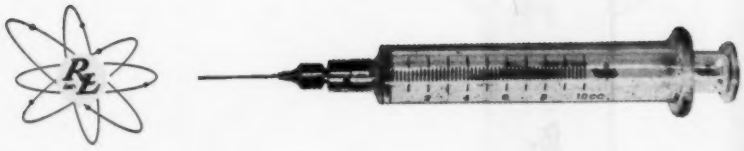

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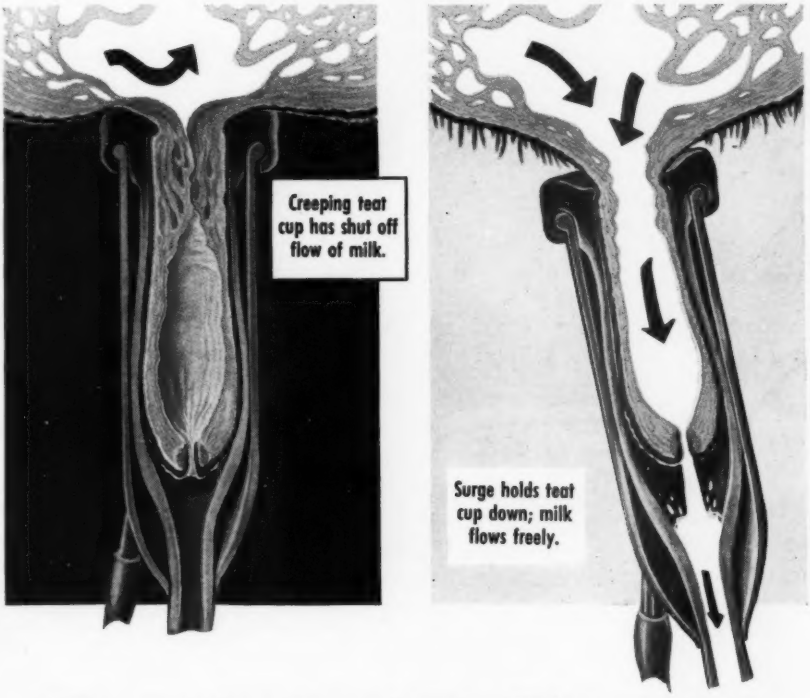

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—DEATHS OF VETERINARIANS—

Theodore W. Alt, Denver, Colo., KSC '46, Dec. 21, 1955.

Louis E. Baxter, Bernardsville, N. J., UP '12, April 11, 1956.

L. H. Becker, Maquoketa, Iowa, CVC '12, Feb. 10, 1956.

Milton A. Bosley, Washington, D. C., USC '17, March 30, 1956.

Ralph R. Claybaugh, Freeport, Ill., CVC '14, Jan. 20, 1956.

Charles R. Donham, Lafayette, Ind., ISC '21, April 24, 1956.

Daniel Ellinwood, Amory, Miss., TH '16, Nov. 11, 1955.

Adolph G. Falk, Hartley, Ohio, CIN, '06, Feb. 13, 1956.

Parker J. Flagg, Newport, Maine, ONT '13, Oct. 13, 1955.

Ruben S. Gerber, Dalton, Ohio, CVC 13, March 13, 1956.

George Gordon, Sacramento, Calif., SF '04, March 26, 1956.

Arthur W. Hopkins, Calgary Alta., ONT '17, March 13, 1956.

Edward J. Higgins, Orient, Iowa, KCV '09, died recently.

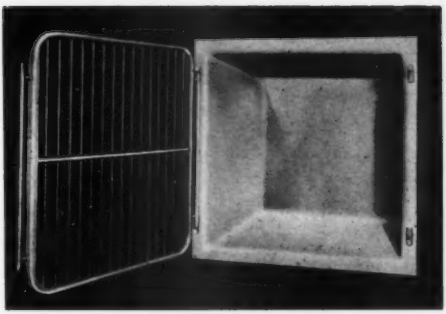
E. A. Johnson, Platteville, Wisc., CVC '96, March 5. 1956.

Thomas L. Kelly, Port Clinton, Ohio, ONT '96, Feb. 24, 1956.

William H. Mahon, Pittsfield, Mass., ONT '05, Feb. 6, 1956.

Philip F. R. Meyer, Fort Worth, Texas, CIN '05, April 12, 1956.

James T. Mills, Oklahoma City, Okla., KCV '16, April 16, 1956.



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